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Vol. CLX. No. 3107.] LONDON, NOVEMBER 29, 1922. [74th Year. Price 1s.



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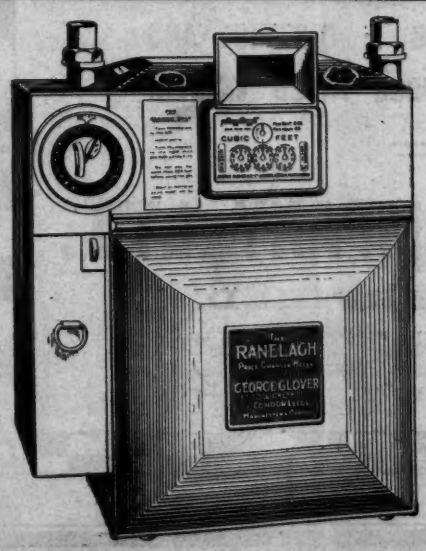


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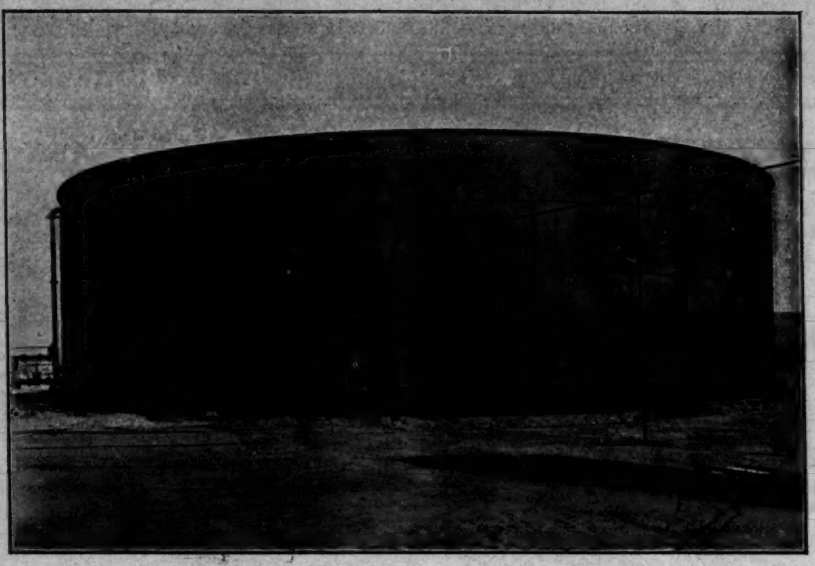

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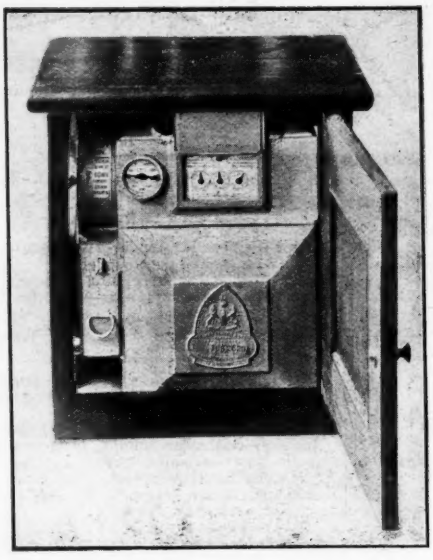

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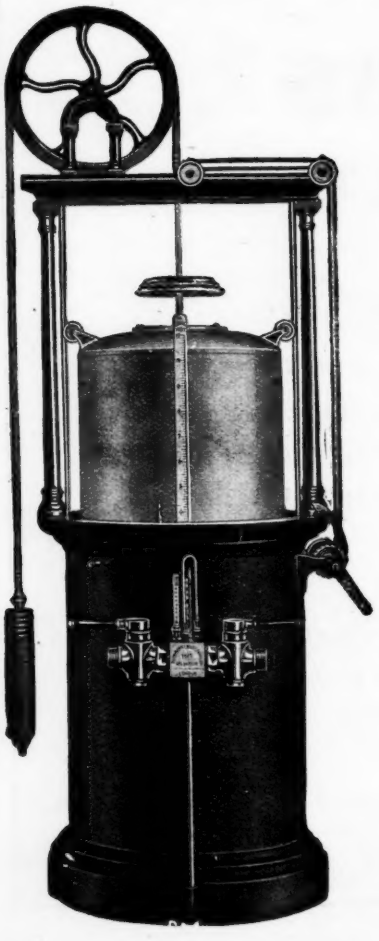

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VOL. CLX., No. 3107.] WEDNESDAY, NOVEMBER 29, 1922. [74TH YEAR.


## EDITORIAL NOTES.

### Economic Aspects of Modern Carbonizing Methods.

THE paper that Mr. Thomas Carmichael read last Thursday before the Southern Association of Gas Engineers and Managers had two purposes. One was to demonstrate from the large and varied experience at Portsmouth the economic advantages derived there from the adoption of modern carbonizing methods; and the other was to raise a good discussion. In both objects the author succeeded admirably—in the second respect probably beyond anticipation, for the paper literally teemed with discussable points, or points upon which criticism could be made. The contribution is also valuable from the point of view that having two works, and at each Woodall-Duckham continuous vertical retorts, horizontal retorts, and water-gas plant (blue and carburetted), and that Durham coal is used at one, and Derbyshire coal in the verticals at the other (or a mixture of the two could be employed), he has been in the position to collect a vast amount of highly useful comparative information. This information it is clear has been obtained in circumstances in which favour has had no intentional part—though, as pointed out in the discussion, to compare results from new settings of verticals with those from old settings of horizontals, and to give to the horizontals the screenings from unscreened Durham coal, are detracting points in the comparisons. The various types of plant are described in the paper; the central feature being the first section of a new vertical installation on the Woodall-Duckham system at Hilsea, with a nominal capacity of 1½ million cubic feet. Under ordinary working conditions, however, the output (corrected to normal temperature and pressure) is 1,788,000 of 465 B.Th.U. gas per twenty-four hours, which is equivalent to 8310 therms from 103·5 tons of coal, or 80·4 therms per ton; and this is allowing 10 p.ct. of the plant out of action for scurfing.

As indicated, the chief value of the paper lies in the comparative results from, and costs with, different types of gas-producing plant. But before considering these, the old point arises as to the suitability of Durham coal for continuous vertical retorts. Over this there has been much controversy; and despite all the assurances that it is only a question of temperatures and throughput whether Durham coal can be successfully used, down South there are some managers with experience of verticals and Durham coal who are hard to convince that that coal has the right characteristics for the best working. On the other hand, even down South there are engineers (like the President, Mr. J. M. Campbell, of Margate) who are not disposed to agree as to the unsuitability of Durham coal. The difficulty of composing these differences of opinion is not an easy one; and they appear likely to continue—at any rate for the present. Of course, in the area where Durham coal is available without heavy transport charges, reduced throughput (if unavoidable) can be tolerated in view of the saving in cost; but at long distances away from the source of the coal, naturally throughput is a matter that becomes more important in relation to general carbonizing economy. When to reduced throughput is added extra labour through hanging charges, the matter becomes more serious, though here comes in, challenging the validity of the complaint, the experience that freedom from hanging charges is only a question of correct temperature; and Mr. Carmichael's temperatures are on the low side in the vertical testings compared with the general practice, though he is using higher heats now. However, his experience at the Flathouse Works with the continuous vertical retorts and Durham coal has been, as he describes it, "rather unfortunate;" and that is not overstating the matter when one finds that throughput is not more than 3¼ to 3½ tons, instead of 5 tons, besides which the rodding work, and so the cost of labour, is increased. But there was less trouble when the unscreened Durham coal was screened by hand, less inerts, and naturally reduced labour; but the screenings are handed over to the horizontal retorts, and so probably in a measure depreciate their results. When there is increased rodding too, wear and tear is of course increased. But there is little doubt that the trouble with Durham coal is in using it unscreened, though even screened the throughput is not so high as with some other types of coal. For an unvarying level of good working, Sir Arthur Duckham is convinced that it is better continuously to use coal of the same class. However, in the new Hilsea verticals, Derbyshire coal is carbonized, and good results are realized both in regard to make and fuel.

As we have said, the comparative costs from the different plants are the most interesting part of the paper, and will be valuable, with due regard paid to the conditions of working. Now it is perfectly clear that if at Hilsea seaborne Durham coal at 27s. 10½d. per ton (*plus* a small amount for transferring it from Flathouse to Hilsea) could be used with equally good results in the verticals, it would be more profitable than using Derbyshire coal at 32s. per ton. There is no reason why in verticals the secondary product results should not be as good with Durham screened as with Derbyshire coal. Assuming 1s. 6d. per ton is the expense of transport to Hilsea, this would make the cost of Durham coal delivered there 29s. 4½d. per ton. Supposing, again, that the secondary products were equal in amount and value to those mentioned for Derbyshire coals carbonized in the new verticals (realizing 18s. 7¼d. per ton), then the net cost of the Durham coal would be 10s. 9¼d., as compared with 13s. 4¾d. for Derbyshire coal. A further small amount would have to be deducted from the difference for screening. However, with the horizontal retorts at Flathouse, and 16s. 10d. realized for the secondary products, the net cost of Durham coal is 11s. 0½d. per ton; so that it should be possible to deliver screened coal to the Hilsea verticals at about the same net cost. But there arises the detracting feature of reduced throughput. There was some criticism of the secondary product figures, especially coke—9 cwt. for sale being given for both the new Hilsea verticals and for the Flathouse horizontals. With this matter Mr. Carmichael dealt in his reply. There is another interesting point, which shows that to-day results should be given not only at per ton and per 1000 c.ft., but at per therm. The net cost of the Derbyshire coal and labour on the new verticals is 15s. 0·25d. per ton; for the horizontals with Durham coal, 13s. 8·2d. per ton—the latter being about 1s. 4d. less per ton. Per 1000 c.ft. the figures change positions—being respectively 10·42d. and 12·58d.; but the gas is not of the same quality. Per therm, the figures are 2·24d. for the verticals, and 2·44d. for the horizontals—the latter with the advantage of the cheaper coal. But this difference would further shrink when differences in capital costs are taken into account; and capital costs are on the down grade. Comparative figures per therm for the blue water gas are: When working two sets at Flathouse, 2·7d. per therm; when working one set, 2·93d. per therm. At Hilsea, the figure is 2·65d. per therm, owing to certain working economies through the use of the telpher. Anyway, both horizontal working and vertical working show a lower therm cost—the cheapest therm being obtained by steaming the vertical retort charges. A mixture of 465 B.Th.U. composed of 76·5 p.ct. of coal gas

(515 B.Th.U.) from horizontals and 23·5 p.ct. of blue water gas (303 B.Th.U.) could not be produced at less cost than 2·5d. per therm, compared with 2·24d. for the same quality of gas produced from Derbyshire coal by steaming in vertical retorts. On the other hand, much credit is due to the water-gas plant. It is acknowledged all along the South Coast that, if it were not for water-gas making, coke prices would have to be appreciably reduced. So there is good compensation for the somewhat higher cost per therm. It should be mentioned that the total cost of carburetted water gas at Flathouse is 3·62d. per therm when operating two sets, and 3·71d. per therm when running one set.

Among miscellaneous points, Mr. Carmichael shows cause why he has not hitherto adopted a waste-heat boiler; but after the discussion, the position is going to be reconsidered by him. He also shows the necessity to-day of working-out capital not only on the 1000 c.ft. basis, but upon the therm basis. His Company's capital has made substantial descent per 1000 c.ft.; per therm it has slightly ascended. Every point in the paper is worthy of consideration. It is good in every respect; and the author deserved all the encomiums that were passed upon his contribution to the proceedings of the Association and to carbonizing literature.

## Economy of Smoke Abatement.

BRIEF phrases sometimes occur which have a great deal of meaning in them. "The economy of smoke abatement" is one. Many people when they begin to talk of smoke abatement, and what can be done with the non-smoke-producing heating agents at present available, drastically limit their view of economy. They merely try to calculate what proportion of the potential heat the different heating methods make available for a given expenditure on the various fuels. Actually, fuel cost is only one of the items in the question of economy; the relative economies compared with uneconomical coal in respect of labour, air pollution, and destructive work are altogether overlooked as having any financial bearing. That is altogether wrong. They also take a given expenditure on (say) coal and gas, ascertain the amount of heat transmitted to a room by the amount of coal or gas purchased, and say that coal is the cheaper agent, and leave it at that. This again is quite wrong. The period of useful service should be a factor in the calculation. They should take the cost of gas during the periods that the gas-fire is usefully employed from the time of lighting-up to extinguishing, and this over (say) a winter month. For comparison, they should take a corresponding room over the same month and the total cost of maintaining in it a coal fire during that period for service at those times when it is only usefully employed, and then see what are the relative results. The convenience of being able to light up and extinguish a fire as and when required is an economy which should be credited to the fuel—quite apart from those other economies in household labour which a piped smokeless, non-ash-yielding, and non-storage-requiring fuel produces.

The economy of smoke abatement was the subject of a paper by ex-Bailie W. B. Smith at the Royal Society of Arts last Wednesday. The author was a member of the Departmental Committee on the Abatement of Smoke and Noxious Vapours which was presided over by Lord Newton, who was in the chair at the meeting on Wednesday. Mr. Smith has made an extensive study of the smoke-abatement question; and his paper shows that he has not succeeded up to the present in finding anything better than gas for room heating and cooking, with coke-boilers for economically supplying hot water. But he is desirous of greater progress, so as to bring gas on to more equal lines with coal as a fuel agent, both for domestic and industrial purposes. That is good; it is the ambition of the men of the gas industry. A curious thing, however, is that so many men who make a study of this matter of smoke abatement, but do not live in the technical work which reveals disabilities, get diverted from the road leading to a practical goal to the advocacy of a smokeless fuel made by carbonizing at lower temperatures than are the practice in gas-works. Mr. Smith is one of these. We take it he has not the technical knowledge to enable him to make fair judgment. Low temperatures in coal carbonization, with the view to leaving a larger percentage of volatile matter in the coke, means increased carbonizing plant and coal and coke handling machinery in proportion to the output of gas; and therefore, to meet the requirements for gas, a capital expenditure would be required out of all proportion to that needed in producing therms the gas way by high-temperature carbonization. This would mean that the provision of solid smokeless fuel by the low-temperature system, with the low gas product per ton of coal, would raise the cost per therm of the most labour-saving and best smokeless fuel known. This would be retrogression, instead of progression. We cannot look upon smokeless fuel produced by low-temperature carbonization, despite the reproaches cast upon the gas industry by Prof. H. E. Armstrong, and the advocacy of Prof. Bone, as anything more than an expensive temporary expedient with the view to securing a solid smokeless fuel, which will not reduce labour so far as lighting-up fires, maintaining them, clearing away ashes, and carrying the fuel from domestic store to the several rooms, are concerned. The better way is to continue at work along the line that will yield the maximum benefit in labour-saving and non-pollution of the atmosphere; and that line is the gaseous one. It is the one that must in the end have supremacy, as among the smokeless agents it has now. Prof. Bone, in spite of his leaning towards solid smokeless fuel, agrees that the gas-fire has been brought to a high degree of perfection, both hygienically and from the point of view of radiant efficiency; and he says that, if gas could be supplied at a cheaper rate, it would provide a good practical solution for a great part of the trouble on the domestic side.

In the paper, the author had something to say as to the disinclination of the Ministry of Health to make a move in enforcing the adoption of smokeless methods of heating in new houses—so helping to perpetuate the mischievous methods of consuming raw coal. Some people say that legislation would not effect any good purpose in this direction. To make a beginning, legislation need not be too drastic, nor all-compelling in respect of every situation. But there are not a few people who will not do anything in promoting economy and better conditions unless by the unavoidable persuasion of compulsion. There are "road-hogs," and legislation has had to be applied to them. If to them, why not to those who make insanitary atmospheric conditions. We would much rather have a voluntary system, if people were all disposed to do their part in helping to ameliorate atmospheric pollution. That they are not, is a reason for applying a little compulsion. Prof. Armstrong dogmatically asserts that it is no good asking the public to adopt gas. Whether asked or not, the public do adopt it. The Professor has something to muse over in Mr. F. W. Goodenough's information that, during the last three years in the district of the Gas Light and Coke Company, the increase in the gas appliances fixed has been 100,000, of which 50,000 were connected during the past twelve months. This is not only an answer to Prof. Armstrong, but to the recent newspaper therm "stunt." It is evident there is a fast-growing appreciation on the part of the public of the economies of gas, apart from the bare fuel cost.

## Liquid Purification by the "Seaboard" Process.

THE liquid purification of gas has been much talked and written about in this country; but the disposition has been to cling rather tenaciously to the old methods, though the new processes offered have been many, and varied in their details and purification efficiencies. In later columns this week we reproduce an account, by Mr. F. W. Seymour, of the operation of a Koppers or "Seaboard" 2 million c.ft. per day liquid purification plant, which has been installed at the Battle Creek Gas-Works, Michigan. It appears to have had to meet there very onerous conditions, in regard to both sulphur and hydrocyanic acid; but the results presented testify to an ability to give good satisfaction.

There can be no doubt that the question of purification requires to be thoroughly explored in the light of changed circumstances to day. But many engineers making lower-grade gas have not even considered the need of harmonizing their purification methods to the altered characteristics of their gas. What has happened in America has occurred here with equal, and perhaps more general, intensity. Modern gas-manufacturing methods with the lower calorific grades of gas have increased certain undesirable ingredients, the presence of which has covert and disastrous action on the metalwork of holders, mains, services, and meters; and at least one of the impurities—hydrocyanic acid—has not been conducive to good working of the purifiers. There is, as Mr. Seymour says, need to-day of more flexible and efficient purifying plant, which will meet not only the

new conditions, and the extensive work to be performed, but will deal with the gas product of coals having a greater range of sulphur content. His experience, he in effect asserts, warrants him in stating that the "Seaboard" liquid process provides what is desired and is requisite. In this process, a dilute aqueous solution of sodium carbonate (or soda ash) is used. There we have a definite chemical compound, which can be cheaply and easily secured. There is nothing so definite about oxide of iron, the efficiency of which varies considerably. In the scrubbers of the "Seaboard" plant, spiral tiles or coke can be employed; but Mr. Seymour believes in the latter on account of low first cost and the good scrubbing contact obtained. There seems to be nothing about the system to occasion any high cost—simply the outlay on the soda, and the steam and maintenance required by one small fan and pump. In fact, looking at Table B, it is observed that, with the 2 million plant at Battle Creek, the cost of purification, including the operation of the oxide catch-box, only amounts to 0·386 c. per 1000 c.ft. That in all conscience is cheap enough, particularly considering the work that is done. The plant has been used for straight coal gas and a mixture of coal and water gas; and it has functioned equally well on the mixture. In some of these liquid purification processes, tar and oil have constituted a difficulty that has depreciated results; but in this case the activity of the solution does not appear to have been in any way lessened.

Table A shows that gas having a sulphuretted hydrogen content varying between 196 and 335 grains per 100 c.ft. has left the plant with in the former case an average of 18 grains, and in the latter 36 grains. The purification efficiency, in fact, is mostly in the neighbourhood of 90 p.ct. —generally speaking, rather above. Of course, this means oxide catch-boxes; but the cost of running these is almost negligible with such little work for them to do. Thus there is long continuous operation before the boxes require to be changed. We understand that Messrs. Woodall, Duckham, & Jones (who have acquired the British rights) have arranged for a plant to be erected at once on a medium sized works. It will deal with 750,000 c.ft. of gas per day, and will be capable of eliminating the whole of the sulphuretted hydrogen, but it will only be called upon to reduce it to about 0·1 p.ct., with the present oxide purifiers completing the extraction. The cyanogen in the finished gas, the Battle Creek experience shows, is very low. Not only do analyses confirm this, but the tests made in the meter-shops disclose that there has been a "splendid improvement" from the state of deterioration that was previously proceeding. Several other advantages are mentioned in Mr. Seymour's statement; but he does not omit reference to the one disadvantage, which is freely forgiven in view of the benefits. It is that the foul actifying air from the vent-pipe has a very disagreeable odour; but at Battle Creek the elimination of cause for complaint is being effected by piping the foul air to the boiler-house, and disposing of it under the grate-bars of the boilers. Does this affect the efficiency of these? As soon as the plant for the construction of which the owners of the British rights have arranged has been working for a period, we hope to have the privilege of publishing the results showing the purification efficiencies actually realized.

## Sulphate Co-operative Trading Enterprise.

WHEN writing last week on the annual report of the Sulphate of Ammonia Federation, Ltd., we had not before us the account of the proceedings at the annual meeting, and had therefore not seen the interesting address by the Chairman (Mr. D. Milne Watson). In it there are two or three matters we should like to point, because they distinctly emphasize the broad view taken by the Executive in managing the affairs of the Federation. There was a time when criticism attached to the Federation the avaricious purposes of a Trust. But the Federation had higher and larger aims than that—aims which had relation not only to the present, but to the future. The idea was to be constructive, as well as protective, by the influence and power that co-operation gives. The influence and power, the makers of over 90 p.ct. of British sulphate production agree, have been employed with discretion and good effect; and the home farmers, in obtaining their supplies last spring at £17, while foreign consumers had to pay £22, have found the Federation are desirous of regarding the interests of producers and consumers as mutual. And they are. The patronage of home farmers has to be developed; and they have to be encouraged to use more and more sulphate. Of course, business cannot be done at a loss. But prospects have to be taken into account; and prospects beyond a limited period have not much certainty about them—at any rate, so far as export trade is concerned. But the Federation are operating to ensure that, when the tide of competition rises, the British producer shall be in the best possible position. In this connection, the Chairman had a very satisfactory and significant piece of news to give. A few members have been lost, representing 3556 tons of sulphate; but the membership of the Federation to-day accounts for more than 90 p.ct. of British production. The greatest competition that bye-product sulphate of ammonia will have to meet some day will be from synthetic sources. Synthetic nitrogen plants are being built in this country. There is the one at Billingham owned by Synthetic Ammonia and Nitrates, Ltd. They have had a small plant on a commercial scale running for upwards of a year; but in six months' time, the large plant will be in operation. The good piece of news that the Chairman had to announce was that this important Company have decided to throw in their lot with the bye-product sulphate manufacturers, and to join the Federation. The Company naturally must realize that their interests are with the resources of existing co-operative effort, which is constantly at work to increase consumption at home, and not only to maintain, but to enlarge, British business abroad. There will be substantial competition to meet in the future; the co-operative way is the best for meeting it. The sulphuric acid makers should also see that it will be to their interests to co-operate. There must be a reduction in the price of sulphuric acid if the sulphate makers are to adjust their costs of production to the level of the selling prices for nitrogen which may be expected in the not distant future. The sulphuric acid manufacturers would do well to put due emphasis on the statement of the Chairman of the Sulphate of Ammonia Federation that "we intend to make the most "strenuous efforts to get our acid at a much cheaper price "than we are now having to pay."

## Atmospheric and Cerebral Fogs.

London had an unusual experience on Tuesday of last week. From early noon, the day was turned into the darkest of nights. There was no fog worth speaking about in the streets during this period; but overhanging was a thick dense canopy, which defied the penetration of daylight. Dr. J. S. Owens explains that the fog was caused by the smoke of London chimneys, which was held like a pall over the city through the anti-cyclone which prevailed over England. The heavy cloud above appears to have had a very bad effect in befogging the brains of the London County Council. On a motion by Mr. Harris, they decided to refer to the Public Control Committee the question as to how far fog in London is caused by the pollution of the atmosphere due to preventible causes. It was also resolved to ascertain whether, by the use of electricity for power and other purposes, the atmosphere of London might be improved, and whether any, and if so what, further powers are required to deal with the emission of smoke in London. The Council generally, and Mr. Harris in particular, apparently have not heard of the several inquiries that have been held (that by Lord Newton's Committee is the latest) into the question of fogs, which inquiries have shown that their density and mischievous character are due to the burning of bituminous coal in domestic fireplaces and factory furnaces—the former being collectively the greater sinners. If the burning of bituminous coal could be got rid of, the trouble would be reduced to nothing more than clean mists. Of course, the use of electricity for power and other purposes would contribute to the improvement of the atmosphere. But the domestic chimney is credited with four-fifths of the trouble; and Mr. Harris and the County Council must be ignorant on the question of the cost of electricity for heating purposes, if they think it is the solution of the great problem. Also they must have been indulging in Rip van Winkle slumbers if they have never heard of the more cheaply operating gas-fire, which with gas-cookers has done so much to lessen the density of the old fogs which were reputed to be a speciality of London. Succeeding one newspaper report dealing with the County Council resolution, it is stated that just as the fog was settling down on Acton on Tuesday night, the electricity supply failed in one of the sections; and a defect in one of the mains was remedied only after one-and-a-half hours' work.

### Another Use for Carbon Monoxide.

Apart from the excellence of carbon monoxide as a heating agent in town gas, it appears to be of use in another way. The fact came out at a meeting of the Royal Geographical Society on Monday evening last week. Captain G. I. Finch, who took part in the Mount Everest Expedition, stated that he and two other members of the expedition camped at 25,500 ft. for over twenty-six hours, and all that time they used no oxygen. About half an hour after arrival, he noticed, in a very marked fashion, that unless he kept his mind on the question of breathing—making it a voluntary process instead of an involuntary one—he suffered from lack of air. He had some thirty cigarettes with him, and as a measure of desperation he lit one. After deeply inhaling the smoke, he and his companions found they could take their mind off the question of breathing altogether. Probably the smoke acted as an irritant, and took the place of the carbon dioxide in which the blood is deficient at these high altitudes. The effect of a cigarette lasted at least three hours; and when the supply of cigarettes was exhausted, they had recourse to oxygen, which enabled them to have their first sleep at this great altitude. Prof. Haldane, in the discussion, remarked that a man thoroughly acclimatized at 20,000 ft. would require very little oxygen to carry him to the top of Mount Everest. The effect of the cigarette smoking was probably due to the carbon monoxide in the smoke, as it was possible that a little carbon monoxide at such altitudes would buck one up.

### Gas Coal Exports.

The quantity of coal of all kinds exported during October reached a figure that must have gladdened the hearts of the colliery owners. It was 6,196,411 tons, which compares with 1,417,498 tons in October, 1920, and 3,405,972 tons in October, 1921. Of the total 810,998 tons were classified as gas coal, which amount compares with 164,119 tons in October, 1920, and 472,082 tons in October, 1921. The value of the gas coal shipped last month is £889,992, or just under £1 2s. per ton. In the past ten months, the total quantity of coal of all kinds shipped is 51,672,984 tons, as against 21,269,053 tons in the same period of 1920, and 16,757,526 tons in that of 1921. In the ten months 7,536,030 tons of gas coal were exported, with a value attached of £8,279,024. The quantity of gas coal shipped in the corresponding period of 1920 was 1,751,241 tons, with a value attached of £6,961,489. In the same period of 1921, the amount was 2,611,065 tons, with a value of £5,309,648.

### Shipments of Gas Coke.

The shipments of gas coke are also bounding upwards. The quantity last month was 114,884 tons, of a value of £154,111, or an average of £1 6s. 9·9d. per ton. In October, 1920, 43,808 tons were shipped; the value being no less than £311,257. In October, 1921, 56,852 tons were exported; but by that time there had been a considerable drop in value—the total figure being £89,008. In the past ten months, 700,642 tons of gas coke were exported; the value being £994,986. In the corresponding period of 1920, a less amount was shipped—676,034 tons, having the enormous value of £4,171,191. In the same period of 1921, 327,797 tons were sent abroad; the value being £733,371.

### Sulphate of Ammonia Exports.

There was a decline last month, contrasted with October, 1921, in the quantity of sulphate of ammonia shipped from this country; the figures being respectively 9659 tons and 11,558 tons. Nevertheless, the total for the past ten months reached 113,280 tons, which is an increase of 4573 tons on the corresponding period of 1921.

### Gas Coal Position.

With industry reviving—though perhaps rather slowly—the effect is being felt by gas undertakings in the industrial areas; and this is giving a distinct fillip to the demands for gas-making coals from such quarters. Adding to this the normal needs of winter for domestic purposes, Durham and Northumberland, with a considerable export business, report that the call for gas coals upon their collieries continues very heavy. But Yorkshire still appears to have surplus supplies, and would like to see a greater demand. From all other quarters, it is reported that supplies are going away freely.

## PERSONAL.

In the paragraph last week mentioning the names of some members of the new Parliament familiar to readers of the "JOURNAL," that of Mr. C. S. GARLAND should have been included. Mr. Garland was elected as a Unionist to represent South Islington. He is Managing-Director of Lighting Trades, Ltd., Vice-Chairman of the Society of Chemical Industry, and Chairman of the Joint Industrial Council of the Gas Mantle Industry. Mr. GEORGE S. CLAYTON, D.Sc., who displaced Mr. Arthur Henderson at Widnes, is a Director of the United Alkali Company and of the Liverpool Gas Company.

Mr. WILLIAM M. CARR, of Ormskirk, has accepted the post of Engineer and General Manager to the Stretford and District Gas Board. He acted for the Joint Authorities forming the Board in the promotion of their Bill in the last session of Parliament, which Bill, it will be remembered, caused a considerable amount of controversy in the Technical Press, as to whether it would be most beneficial to the general public for the undertaking to remain in the hands of the Manchester Corporation or be transferred to a Board of Authorities served by the undertaking. Mr. Carr has contended that the cheapest gas is not necessarily made in the largest works, and that, so far as the management and control are concerned, results seem to point to the fact that there is in gas-works an economic limit in size. He is taking up the position at Stretford in the hope that he will be able to show that the public can be equally as well served by the Board as they might have been by the Manchester Corporation.

Mr. H. A. AITKEN, Works Manager of the Longton Gas-Works, was presented last week with a handsome smoker's cabinet by the Chief Gas Engineer (Mr. A. McKay), on behalf of the staff and workmen. Mr. Aitken is leaving the district to take up new duties as General Manager of the Leven and Wemyss Gas-Works.

At the Stoke Gas-Works, Mr. F. J. BRIDGWOOD was presented by the staff and workmen with a silver cigarette case and holder, on his leaving Stoke to take up the position of Works Manager at Longton vacated by Mr. H. A. Aitken.

## OBITUARY.

We regret to record the death of Mr. W. A. WHITE, the Superintendent of the Neepsend works of the Sheffield Gas Company. Mr. White was at his work as usual last Saturday week, and appeared to be in the best of health; but he was taken ill with pneumonia on the following day, and died on Tuesday, the 21st inst.

## ELECTRICITY SUPPLY MEMORANDA.

THE electricity industry has had to start parting-up for the maintenance of the department and work of the Electricity Commissioners; and discontent reigns in some quarters. It is thought, among other things, that there has been a great deal of unnecessary expense hitherto over the districting and electricity reorganization schemes. There is little doubt there has been; but for this the Electricity Commissioners are hardly blameworthy. However, they have been considering the procedure at the inquiries, with the view of keeping their cost within reasonable bounds. But they do not at present see their way to lay down any rules of procedure which would be an improvement upon the usual course of proceedings at similar inquiries. The fact is that the undue prolongation of the investigations is attributable to a remarkable verbosity and insistence on going into trivial details—the failing being due to both promoters and opponents. Added to this is the generosity of the Commissioners in not "switching-off" witnesses when they have had enough evidence on a particular point. However, in a recently issued Memorandum, the Commissioners state that they desire, in the interests of all concerned, that unnecessary expense shall be avoided, by curtailing the length of the inquiries. They suggest that an endeavour should be made to arrive at agreements by conference before inquiries are held, so that differences may be adjusted or reduced to a minimum; but they do not wish to interfere with the discretion of the parties in regard to employing counsel and calling expert witnesses. As to the latter, the view is expressed that ordinarily it should not be necessary for more than one witness—representative of each class or group of promoting or opposing local authorities or companies—to be called as to policy. Respecting the technical side, promoters and opponents are asked to bear in mind the composition of the tribunal, and that while expert evidence should be adequate to support or criticize the scheme in its different aspects, the mere duplication of such evidence, with the object of adding weight, is unnecessary. A further proposal is that, where possible, there should be only one local inquiry into both the area and the scheme for the district, and that this shall be the principal inquiry. It is pointed out that, when a scheme has been approved as the result of such an inquiry, the proceedings at the further local inquiry should ordinarily be more or less formal, or confined to specific points

**More Economy at Inquiries.**

of controversy. All this will not affect the fearful waste of time and money there has already been through crass superfluity.

**The Cooker Campaign.**

The men of the electricity industry do not appear to be paying so much attention now as formerly to the domestic heating business. They know the shortcomings of such methods of heating; they know, too, it is only a seasonal demand; and they are aware that, if there was a large influx of users of electric-heaters, there would be distribution troubles in meeting the simultaneous demand for B.Th.U. and lighting energy. There is therefore in some places a large concentration on the cooking business in these times; and it is interesting to note the various measures adopted to effect new connections in this direction. A "Looker-on" in the "Electrical Times" has something to say under this head. He shows cause in the first place why electricity undertakings should seek to develop the cooking load. He tells how power loads are inclined to diminish; the war and boom periods having passed. He admits that private and office electric lighting only pays when charged for at a comparatively high price. But it is submitted that a combination rate can be made which is both remunerative and attractive. Is it true that it is only the charge for current that stands in the way of a large development? We think not. There is much more than that. "Looker-on" says that, to develop cooking sales, all that is required is spade work. There is spade work and spade work—some is light, and some heavy. It depends very much upon the character of the soil. The "spade work" seems to include "the cultivation of the field." It is submitted that at the start two main factors are required: The classification of prospective cooking consumers, and an active educational policy in favour of electric cooking. The fact is pointed out that there are in every district various classes of consumers—those who could undoubtedly afford to purchase a cooker; those who would require easy purchase terms; and those who ultimately would probably be able to purchase a cooker if easy terms were offered. In addition, the educational work should include letters, booklets, demonstrations, and exhibitions. An electric restaurant, too, will create consumer interest, which can often be turned into consumer demand. Perhaps the most novel point in the article is that, where a model kitchen is situated in a showroom, it is a good plan to have monthly invitation lunches, when the opportunity can be taken to talk electrically to business and professional men. Representatives of the Press should be asked each time. It is stated that the system of free trial for electrical appliances requires very careful handling, or it will result in heavy expense. This is interesting. According to all the generous postulation of electricians, the virtues of electric cooking should alone ensure that free trial will result in permanent adoption. But evidently this is not so, in view of the warning of "Looker-on." It is the curious and the something-for-nothing lady who is the danger. But the "curious" and the "something-for-nothing" lady must have means for cooking; and as electric cooking is electrically said to be the best, then those who come into those particular categories should also be among the converted. However, the writer is emphatic as to the unwisdom of advertising free trials. His counsel is that it is better to leave to the discretion of the salesman to put forward an offer when he deems it really necessary as an aid to closing a sale. It is, however, suggested that a reasonable charge, which can be set-off against current used, is often helpful. This, it is thought, would help to eliminate the idly curious. A lot of edging-round appears to be necessary in connection with this business. However, the troublesome days of breakdowns and experiment are said to be over. Those who so assert are fortunate in their experiences.

**Large Ideas.**

There is no question that those who are engaged in propaganda work for the electricity industry are taking big measure of possibilities. It is probably part of their business. They must talk large to attract attention. Mr. J. W. Beauchamp, as the Director of the Electrical Development Association, has naturally great ideas as to the future part of electricity in the home. He gives vent to them in an article in the jubilee number of the "Electrical Review." The electricity industry is setting in motion a "far-reaching change" in this respect. Nothing is said as to the revolution that gas has effected in home life by the cooker alone; and electricians know full well that—having regard to the differences that there must be in favour of the costs of gas appliances owing to their relative simplicity, and in running expenses in view of the lower cost of B.Th.U. the gas way—their part in this work will be of a comparatively meagre order. It is all very well to say that "because we have done this and that with lighting and power, we are going to do the same with heating and cooking." The facts are of a totally different order; and the most obtuse electrical mind must see this, if it has a modicum of comprehension in it as to the meaning of those facts. Mr. Beauchamp refers to installation work. In this connection, he says that much was expected of surface-wiring systems; but nothing strikingly novel has emerged in this direction—nothing which can be described as a departure in principle. Therefore, there is still room for the ingenious inventor who can forget everything that has been done, and approach from some new angle the problem of feeding "millions of lamp points and outlets." Apparently, Mr. Beauchamp is content to have different standards of installation work for different classes of householders. The poorer classes of householders would be interested in this. He says it is "becoming obvious that electricity is so very much safer than any of the media which it replaces," that the standard might well be modified in relation to the character of the buildings and the positions that are being treated, or to the amount of responsibility upon the installations when in use. What does this mean? That the factor of safety can well be weakened in the case of the property occupied by the masses of the people? We are surprised at Mr. Beauchamp, if that is his meaning and intention. As to lighting, we read that the modern lamp is a triumph of the manufacturers' art, at less than pre-war figures. As to cooking, Mr. Beauchamp again waxes eloquent. Development has been extremely rapid during the past two years. Figures and experience show it to be a business most desirable [no doubt!], and unaccompanied by many difficulties which were at first anticipated in connection with it. But no doubt Mr. Beauchamp could, without straining his mind unduly, find some difficulties which still exist. However that may be, he advises entrance to the business to be of a more or less modest nature. The reason is not clear. If the electrical way is so good, why not press on with it with full vigour? If an undertaking is not at once able to grapple with domestic cookery, then commercial cookery is a good line. We also read that in some areas the popularity of the electric-fire has had such rapid growth that the resulting load is embarrassing. In acute cases, he advises consideration of the idea of heat accumulation, which would of course represent an additional expense to someone, and that someone the consumer. As to water heating, he is of opinion that this has been tackled with considerable success. There is the self-contained kettle for small quantities of water, and the heat accumulation system and night rates for larger supplies—both frequently discussed, but little applied. He deals with power in the home; and generally comments on the design and construction of electrical apparatus, in connection with which "great strides" have been made. When we examine domestic electrification in detail, complication is a word that it is impossible to dismiss from the mind. The deeper one goes into the matter, the bigger "complication" grows.

**Horse Power and the Heating Load.**

The Canadian correspondent of the "Electrical Review" reports a curious situation in Canada—more particularly in Ontario and Quebec—owing to the fuel shortage. What he has to say will probably cause some electric heating enthusiasts to reconsider the position. It is estimated that there will be about 40 p.ct. shortage of the normal supply of anthracite reaching Canada this winter; and in view of this the use of electric-heaters is growing by leaps and bounds. Through this, it is suggested that it is more than probable that voltage regulation in many municipalities will be particularly bad this winter. Unfortunately, Canadian winters, except on the other side of the Rockies, are so cold that, abundant as are the water powers of the country, there is no possibility that electricity can be used on any generous scale for the heating of buildings. The following facts show this clearly: Actual tests indicate that an average house of six or eight rooms requires not less than from 15 to 20 H.P. to heat it on very cold winter days. In Toronto there are nearly 100,000 houses; and if all these were heated electrically, it is evident that from 1,500,000 to 2,000,000 H.P. would be required for heating houses alone. And this only refers to one city. Moreover, this would be purely a winter load; and the full amount would only be needed on very cold days. On milder days much less would be required. Hence the annual load factor would be low; and the problem would be to find sufficient extra power in the winter to supply other needs, even if enough could be furnished to meet the heating requirements.

**Labour and Electricity Supply.**

Some of the Labour leaders are highly eccentric, and come out with some most fantastic proposals; and the efforts they put forward to secure their adoption are altogether out of proportion to the beneficial effects that would accrue. More often than not the effects would be the opposite of beneficial, as in the case under notice. The Executive Committee of the Labour Party have passed a resolution which suggests that there should be greater activity on the part of Labour councillors in the development of municipal electricity, especially for domestic purposes. The resolution "recognizes that the lifting of the burden of the housewife is dependent on the introduction of cheap labour-saving appliances, and urges that a policy of installation of electricity for all purposes for families of limited means should be pursued." The opinion of the Party is also recorded that experience has shown the impossibility of reconciling the interests of municipal and company undertakings; and it is considered that the Electricity Commissioners have been far too sympathetic towards "profiteering interests," especially those of the power companies. The Party welcomes the endeavours now being made for an all-municipal scheme of generation, and reiterates its conviction that the solution of the difficulties of electricity generation and supply in the London area depends on the elimination of private profit. These defenders of Labour interests overlook the fact that in the generation of electricity there is far less employment than in the case of gas manufacture. They are also talking in a very ignorant manner when they suggest electricity for all purposes for families of limited means. "Limited means" and

electricity accounts for lighting, heating, cooking, and hot-water supply do not harmonize. The "burden of the housewife" can be lifted better and cheaper by gas, in the making of which more employment is given. The resolution would be humorous, if it did not evoke our sympathy by the ignorance displayed in it.

**In "Model" Dwellings.**

Those who live in the model dwellings of the Shoreditch Borough Council are supplied with current at a cheap rate—2d. per unit. For over twenty years (says the "Electrician"), the occupiers have had electric light; and now the Electricity Department are providing a complete equipment for lighting, water heating, and cooking by electricity. Therefore we may expect that the "band" will soon begin to play. Our contemporary describes the new plan. The lighting circuit is interconnected with a 5 gallon electrically heated water-tank in such a way that during the hours when lighting is not required an equal amount of electricity which would be used for lighting is passed through the heater. This current is diverted to the lamp circuit by the use of two-way switches as desired. By this means a "constant" supply is given the whole 24 hours at the cheapest possible power rate. The hot water supplied by the heater reaches a maximum temperature of about 140° Fahr. In order that the equipment shall be as complete as possible, not only is a wiring installation for four lamps supplied, but also a portable connection for a kettle, and the same for an electric-iron in the living room. The apparatus supplied includes: An electric-oven, a griller and boiling-plate combined, and an electric-kettle (2 pint size). Supply will be given through a shilling-in-the-slot meter; and the whole of the current will be charged at 2d. per unit. As, however, the current used in the lighting and water heating circuit is rated at 1¾d. per unit (being a 24-hour load), a rebate on this supply is due to the consumer. In an ordinary flat where there are four lights, this rebate will amount to 1s. 4d. per month. In a case where more lights are required than can be arranged for through the water-heater circuit, the charge by slot meter will be 2¼d. per unit; and the rebate will be increased accordingly. The charges include maintenance and replacements for fair wear and tear, but not other damage. They cover the hire of the whole of the wiring and apparatus, which is the property of the Borough Council. The installation may, if desired, be purchased by the consumer by instalments. Where does the "profit" for the undertaking come in?

## LOW-TEMPERATURE CARBONIZATION AND THE THERM.

By WALTER CHANEY.

THE writer of the above has pleasure in replying further to Mr. Evetts' criticism contained in the "JOURNAL" of Nov. 15.

(1) Can any low-temperature plant be guaranteed to supply a gas of 750 B.Th.U. yielding 60 therms?

Mr. Evetts mentions in a later portion of his criticism having attained (approximately) 600 B.Th.U. gas yielding 70 therms. It is, therefore, probable that 60 therms may be obtained from a gas of 750 B.Th.U., and a guarantee would be given to produce 50 therms from the same quality gas—*i.e.*, 750 B.Th.U. per c.ft.; the resulting fuel being of a smokeless description, and containing sufficient volatile matter to ignite as readily as coal.

(2) Where can blue water gas be produced at 4d. per therm, with coke at 35s. per ton?

Steaming in vertical retorts is probably the cheapest method of producing water gas. The following results are extracted from Sir George Beilby's paper on "Steaming in Vertical Gas Retorts" ("Transactions of the Institution of Gas Engineers," 1920-21).

*Without Steaming.*

Gas made, 13,100 c.ft.; calorific value, 544 B.Th.U. = 71·26 therms.

*With Steaming.*

Gas made, 20,060 c.ft.; calorific value, 477 B.Th.U. = 95·68 ,,

Increase of therms, presumably water gas = 24·42 ,,

| | Without Steaming. | | With Steaming. |
|---|---|---|---|
| Percentage of coke on weight of coal | 73·32 | .. | 66·50 |
| Tar, gallons | 9·3 | .. | 11·2 |
| Sulphate of ammonia, lbs. | 16·27 | .. | 21·8 |
| Heat value of steam supplied in therms per ton of coal carbonized. | *Nil* | .. | 3·14 |

Assuming the steam for the retorts to be supplied from waste-heat boilers (see Thermal Balance Table A, Sir George Beilby's paper), this extra yield could be produced at a low cost and enriched with low-temperature gas to a town supply. Generally speaking, the writer agrees that 4d. per therm for water gas manufactured by an independent plant might be considered low, but many gas undertakings are at a disadvantage through local circumstances, and frequently unable to realize normal prices for coke. In turning their coke into water gas they may be further penalized by the surplus coke of neighbouring undertakings not manufacturing water gas. A remedy appears to be the manufacture of smokeless fuel to compete with household coal.

(3) With coal at 40s. per ton, coke at 35s. per ton, and a production of 70 therms, is not 8d. per therm too high in the same works with water gas at 4d.?

The writer explained in the "JOURNAL" of Nov. 8 that gas undertaking "A" was supplying a "straight" coal gas, costing 8d. per therm; and the comparison was between this price and the auxiliary supply. The cost of this straight coal gas compares very favourably with similar costs of the Metropolitan and Suburban Gas Companies, 1921, being with one exception from 0·31d. to 2·17d. less per therm. The writer would beg to be excused from expressing his views on the last paragraph of question 3.

Mr. Evetts points out that the calorific question can be dealt with by utilizing a rich gas of 600 B.Th.U. and by utilizing an admixture of two gases instead of three, as follows:

Mr. Evetts' figures . . . . . 11,667 c.ft. of 600 B.Th.U. gas.

| | On Original Basis. | | On Revised Basis. |
|---|---|---|---|
| 77·5 coal gas at 8d. | = 6·2d. | .. | at 6·54d. = 5·07d. |
| 22·5 water gas at 4d. | = 0·9d. | .. | at 5·71d. = 1·28d. |
| Over-all, per therm | = 7·1d. | .. | = 6·35d. |

These figures compare with 8d. per therm on undertaking "A."

Developing Mr. Evetts' suggestion upon the writer's basis of utilizing a richer gas—namely, 750 B.Th.U., yielding 60 therms—

42·25 p.c.t. of 750 B.Th.U. gas . . = 317 B.Th.U.
57·75 p.c.t. of 300 ,, ,, . . = 173 ,, } 490 B.Th.U.

Thermal Value.

3·17 therms low-temperature gas = 64·7 p.c.t. at 6d. = 3·88d.
1·73 ,, water gas = 35·3 p.c.t. at 4d. = 1·41d.

4·90 ,, pence per therm (over-all) = 5·29d.

Original cost of gas at undertaking "A" = 8d. = 2·71 saving.

64·7 p.c.t. low-temperature gas at 6d. . . . . = 3·88d.
35·3 p.c.t. water gas at 5·7d. . . . . = 2·01d.

Price per therm (over-all) . . . . . 5·89d.

Original price 8d. . . 5·89 = 2·11d. per therm.

As Mr. Evetts points out, a gas of 600 B.Th.U. can be obtained by lowering the temperature of the ordinary gas retort, but the resulting coke consists of partially baked coal, and the heat hardly penetrates to the centre of the retort. The main object of low-temperature carbonization is the production of smokeless fuel to compete not with coke but with household coal; the gas, being a secondary product, can be sold at a comparatively low price, and the production of oil more or less controlled to accommodate the condition of the market for that commodity.

It is obvious that apart from the smokeless fuel the products of low-temperature carbonization are much more valuable than those of the high-temperature process, for the reason that the volatile matter in the coal, containing motor spirit, fuel oil, and ammonia, is not decomposed so far into gas, and that the latter product is of less value in consequence.

The apprised value of 4d. per therm mentioned in the Fuel Research Board's report may be of particular interest as a basis to those dealing with complete gasification schemes.

| | Thermal Basis. |
|---|---|
| 71·4 p.c.t. of 300 B.Th.U. gas . . . . . | = 214 = 42·8 p.c.t, |
| 28·6 ,, ,, 1000 ,, ,, . . . . . | = 286 = 57·2 ,, |
| Town gas of . . . . . | = 500 |
| 42·8 p.c.t. of gas at 5·7d. . . . . | = 2·44d. per therm |
| 57·2 ,, ,, low-temp. gas at 4d. . . . . | = 2·29d. ,, |
| 500 B.Th.U. town gas . . . . | = 4·73d. per therm |

Personally the writer has never been fortunate enough to deal with a gas of 1000 B.Th.U.; but it tends to illustrate the economy of making as high-grade gas as possible for enriching purposes.

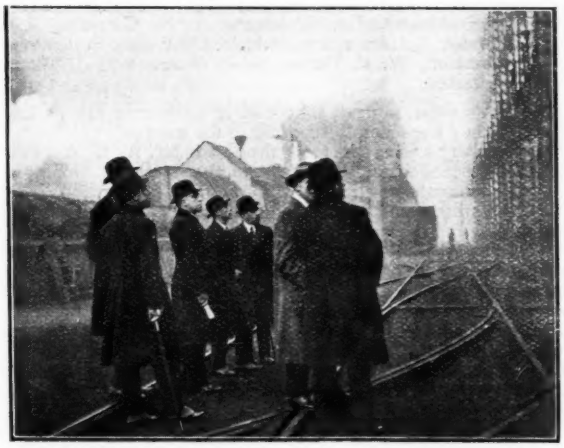
**Testing the Tensile Strength of Gas-Mantles.**—Recently before the Physical Society, Mr. J. T. Robin, of the Incandescent Mantle Works, Streatham, demonstrated his apparatus for testing the tensile strength of gas-mantles. Though, says "Engineering," the mineral skeleton of a mantle (consisting of the nitrates or oxides of thoria and a little ceria) weighs only about 1 gramme, a good mantle will sustain a weight of 70 grammes, and even of 250 times its own weight, while a weak mantle may fail under a load of 30 grammes. In the Robin test the mantle generally breaks in a horizontal plane, near the supporting ring; the fracture of a badly-made mantle will be irregular.

**The Education of the Chemist.**—Dr. O. L. Brady, F.I.C., addressing the Chemical and Physical Society of University College, on "The Education of the Chemist," said the reason why the status of a chemist was not as high as that of other professions—such as medicine or law—was due in a large measure to the incomplete nature of his training. Present-day specialization has resulted in men who, though extremely well-read in their own branch of science, have no education or interests outside their work. The present period of three years is quite inadequate preparation for a degree, and he would like to see the Universities once again made places where a general education in all branches could be obtained. The prospective chemist, while acquiring this, could find out his natural aptitude—whether for research, the teaching profession, or industrial work. Then, at the end of three or four years, he would proceed to a technical college or university, where the type of training suitable to his chosen career could be obtained.

# H.R.H. THE DUKE OF YORK AT THE BECKTON GAS-WORKS.

ALTHOUGH the Gas Light and Coke Company owe their origin to a Royal Charter granted by King George III., it is, so far as is known, more than sixty-six years since any member of the Royal Family has honoured any of the Company's works with a visit of personal inspection. For this reason they value more particularly the visit which the Duke of York paid to the Company's gas and products works at Beckton, and to the sports ground at East Ham, on Tuesday, the 21st inst.

His Royal Highness is exceedingly interested in welfare work This was one of the reasons which led him to visit the largest gas-works of the largest gas company in the world; so that he might make himself personally acquainted with the methods by which the Company provide for the welfare of their vast number of employees, a large proportion of whom are co-partners under the Company's scheme, and for whose physical welfare the Directors have provided sports grounds, exceeding 80 acres in extent, at East Ham and Acton.



The fog, which lay like a pall over London, was absent from Beckton; but, unfortunately, the light was not particularly good for photographs to be obtained, though we are able to reproduce three of some interest.

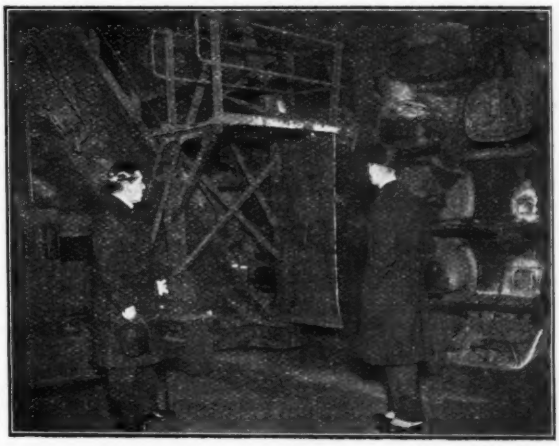
The Duke, accompanied by Wing-Commander Louis Greig, M.V.O., Comptroller of his Household, arrived punctually in his motor car at the Company's offices at the Beckton manufacturing station, where he was received by Mr. D. Milne Watson, the Governor of the Company, who then presented to His Royal Highness some of the prominent officials, including Messrs. T. Hardie (Chief Engineer), R. W. Foot (Assistant General Manager), W. B. Leech and E. J. Hutchence (Resident and Deputy-Resident Engineers at Beckton), and others. The Duke also shook hands with the members of the Works Committee, including the four co-partnership representatives of the station, three senior foremen, and three old workmen whose joint service with the Company totalled 144 years.

The Duke then proceeded on foot to the war memorial unveiled on June 13 last. After inspecting the bronze tablet recording the names of the 500 men in the Company's service who fell during the war, 97 of whom were Beckton men, the Duke entered the Directors' saloon carriage and proceeded by train to No. 1 pier, from which he obtained a general view of the river and of the plant at No. 2 pier for the unloading of coal up to 12,000 tons per day. One of the Company's fleet of eleven steamers was seen unloading at the pier. The train continued its journey through the works to No. 7 retort-house, which has been lately reconstructed and forms a very fine example of modern gas-works practice. The engineers and foremen in charge of the house had the honour of being presented to the Duke, who throughout his progress through the works was enthusiastically welcomed by the Company's employees. He expressed special interest in the work of a retort-house, which was entirely new to him.

The Company's ambulance station was next visited, which is in charge of Dr. Coles, the Company's Doctor at Beckton, whose services, as well as a staff of ambulance men, are always available in the case of accident to any of the workmen.

From the ambulance station the Duke walked to the new workshops. The building is of reinforced concrete, and covers an area of nearly 50,000 superficial feet. The repair work of the station has been concentrated here. Mr. Birks and other officers more particularly concerned with the mechanical engineering side of the Company's work were presented to the Duke, who then walked through the shop and expressed his appreciation of the splendid conditions under which the men carried on their work.

Entering the train again, His Royal Highness reached the Company's tar and ammonia products works, at the entrance of which he was received by Mr. W. Gordon Adam, the Superintendent, who explained the importance of the part played by gas works in general, and the Company's works in particular, in furnishing vast quantities of munitions and other indispensable supplies during the war. After inspecting the naphthalene plant, with its picturesque subliming chamber, and accepting a box of



naphthalene balls, the Duke visited the office, where various officials, the Works Committee, and the lads who had attended and so much enjoyed his camp last August, were presented.

On leaving the tar-works the Royal visitor drove to the Company's sports ground at East Ham. This ground, which extends to some 40 acres, provides space for recreation for the eastern half of the Company's employees; the ground at Acton, of similar size, serving the western division. Here the Secretary of the Sports Association, members of the Ground Committee, and the groundsman were presented to His Royal Highness, who commemorated the close of what is hoped was a most successful and interesting visit by planting a memorial tree.

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**Scottish Junior Gas Association (Eastern District).**—After an inspection of the Kirkcaldy Gas-Works on Saturday afternoon, Dec. 9, Mr. Arthur M'Donald will read a paper describing reconstruction work carried out there.

**Natural Gas Losses.**—Mr. R. A. Cattell, the Natural Gas Engineer of the United States Bureau of Mines, who is making a special study of transmission losses of natural gas, is intending to conduct a series of tests on sections of pipe to determine the relation of leakage to pressure. Though all the gas companies are, of course, interested in the subject of transmission losses, comparatively little work has been done to determine certain fundamental facts, such as the effect of pressure on line losses.

**Reports Unavoidably Held-Over.**—Unfortunately, extreme pressure on our space this week has compelled the holding-over until the next issue of the "JOURNAL" of three interesting papers and discussions—namely, those by Mr. J. Terrace, on "The Electro Flow Meter," before the Southern Association of Gas Engineers and Managers; by Mr. A. Bell, on "The Making of Gas and Water Connections under Pressure, and the Uses of Some Modern Tools and Appliances in Gas Manufacture and Supply," before the North of England Gas Managers' Association Auxiliary Meeting; and by Mr. T. A. Gilbert, on "Gas Meters: their Construction and Application," before the London and Southern District Junior Gas Association. The same applies to the visit of members of the Scottish Junior Gas Association (Western District) to the Helensburgh Gas-Works.

# SOUTHERN ASSOCIATION OF GAS ENGINEERS AND MANAGERS.

## ANNUAL GENERAL MEETING.

THE Annual General Meeting of the Association took place last Thursday, at the Charing Cross Hotel, when an unusually large attendance of members—there must have been at least 130 present—was presided over by Mr. J. M. CAMPBELL, of Margate. The two papers submitted, and the discussions, made a full afternoon's business. The President expressed his hearty pleasure at seeing such a good meeting, and said it must be one of the best the Association had ever had.

### A WELCOME.

The PRESIDENT, at the outset of the proceedings, said he would like to offer a hearty welcome to Mr. Ernest J. Lord, the Assistant Engineer to the Brisbane Gas-Works, who was in this country on holiday. He would like the members to show by their applause how pleased they were to have Mr. Lord with them.

Mr. Lord, in response to his hearty reception, said he was delighted to have the privilege of attending the meeting, which would be a pleasant recollection to him on his return to Brisbane.

### CONFIRMATION OF MINUTES.

The PRESIDENT suggested that the minutes of the last meeting, as published in the "JOURNAL," should be taken as read.

This was agreed to, and they were confirmed.

### THE NEW PRESIDENT.

The PRESIDENT said it was now his great pleasure to move that their friend Mr. Hoyte be elected President for 1923. He had during the past year occupied the position of Vice-President, and carried out the duties very worthily. In the West he was well known. In fact, if they were to dissociate Hoyte from Plymouth, he (the speaker) thought there would be no Plymouth. He had taken every possible opportunity of developing the gas industry in that part of the country, and had with great success filled the position of Chairman of the Western Section.

Mr. H. C. HEAD (Winchester) said he regarded it as a great privilege to second the proposition. The President had said "their friend Mr. Hoyte." He (the speaker) would make it "their very old friend Mr. Hoyte." There were not many of those in the room who could remember Plymouth without the name of Hoyte being connected with it. Those who had already been down to the West knew how much those who were going to the West later on would enjoy themselves. They were all looking forward with very great pleasure to that meeting under Mr. Hoyte's presidency. Mr. Hoyte was one of their oldest and most respected members; and he was sure that the Association in his hands would go forward to further successes.

The motion having been carried with applause,

Mr. P. S. HOYTE (Plymouth) thanked the President and Mr. Head very sincerely for the kind remarks they had made about him, and the members for the hearty way in which they had received the proposition. It was, he said, no light honour to be President of the Southern Association. He thought they had a larger membership than any other of the District Associations, and they were certainly as much alive as the others—if not more so. Mr. Head had referred to next year's visit to Plymouth. It was unnecessary to say that they would receive from his Chairman and Directors, and from the members of his staff, the heartiest possible welcome that the West Country could give them; and he could assure them that a West Country welcome was an extremely hearty one. He only hoped they might be favoured with something like the same weather that they had at Exeter when so many of the Eastern members journeyed down there. It meant a great deal to those in the West to see the Eastern members there. As the members were aware, they had there a large number of relatively small works. They had not the big works concentrated there that were found in the Eastern section. He regarded the honour of being made President not only as a personal one, but as a compliment to his Company. It would be the first time that an Engineer of the Plymouth Gas Company had occupied the distinguished position of President of the Association. The Western members also greatly appreciated the honour that had been done him. The only grudge he had against Mr. Campbell was that he was going to be extremely difficult to follow. No more honoured member than Mr. Campbell had ever occupied the chair; but with the Hon. Secretary's assistance and that of a very hard-working Committee, and the cordial support of the members, he trusted that he might acquit himself in a manner which would be a credit to the Association.

### OTHER OFFICERS ELECTED.

Mr. HOYTE said that it was with the greatest possible pleasure he had to suggest as Vice-President for the coming year Mr. Leonard J. Langford, of Tunbridge Wells. [Applause.] As he had anticipated, the applause showed that this was a thoroughly popular appointment with all of them. It had been their custom—and he thought it was a good custom—that the President should be selected alternately from the Western and the Eastern section. Tunbridge Wells was in the heart of the Eastern section; and he submitted, from what they all knew of Mr. Langford, that it would not be possible to find anyone more suitable to fill the vice-presidency in the coming year. He was only too glad to think that, if the proposition met with the members' approval, he would have Mr. Langford's assistance during his year of office.

Mr. C. CHAMBERS (Harrow), in seconding, said he was very glad to know that Mr. Langford was willing to accept office. From what they had seen of his work in connection with the Eastern Section, they knew how well qualified he was to fill the position of Vice-President.

The PRESIDENT supported the proposition. He said he had known Mr. Langford ever since he had been in Tunbridge Wells. He would in due course make an ideal President.

The motion was agreed to with acclamation.

Mr. LANGFORD thanked them very heartily for the honour they had done him in electing him Vice-President. It was an honour he did not deserve; but he would do all he possibly could for the Association. He had only been in the South for five-and-a-half years, which made the honour conferred upon him all the greater.

The HON. SECRETARY (Mr. W. H. Bennett, of Redhill) said the members of the Eastern District had elected as members of the General Committee Messrs. Chas. Chambers and Alec G. Cheal, A.M.I.Mech.E., in place of Messrs. L. J. Langford and W. Phillips, who retired by rotation. The members of the Western District had elected Mr. W. N. Westlake in the place of Mr. James Taylor, who retired by rotation. He also reported the following:

*Committee and Officers for the Eastern District for* 1923.

*Chairman.*—Mr. C. H. Rutter, M.Inst.C.E.
*Vice-Chairman.*—Mr. A. H. Andrews.
*Hon. Secretary.*—Mr. L. Trewby, A.M.I.Mech.E.
*Committee.*—Messrs. Chas. F. Botley, M.Inst.C.E., Chas. Chambers, Alec G. Cheal, A.M.I.Mech.E., J. Fisher, A.M.Inst.C.E., H. C. Head, M.Inst.C.E., M.Inst.M.E., F. Livesey, B.A., M.Inst.C.E., P. G. G. Moon, F.C.S., W. E. Price, A.M.Inst.C.E., F. Smallbone, and J. S. Thorman.

*Committee and Officers for the Western District for* 1923.

*Chairman.*—Mr. S. E. Halliwell.
*Vice-Chairman.*—Mr. Jas. Taylor.
*Hon. Secretary.*—Mr. W. E. Dean.
*Committee.*—Messrs. Jas. Armstrong, J. H. Cornish, C. G. Dawson, J. Harger Pye, A.M.Inst.M.E., H. E. Riley, R. Robertson, W. P. Tervet, E. P. Vince, and J. Wesley Whimster.

The PRESIDENT said all they had to do was to accept these names. They were simply reported to the meeting.

Mr. ERNEST SCEARS (Redhill) proposed, Mr. A. H. ANDREWS (Vauxhall) seconded, and it was agreed, that Messrs. J. Donaldson and J. Urquhart be re-elected Hon. Auditors.

The PRESIDENT said he was going to take upon himself the duty of proposing the re-election of the Hon. Secretary and Treasurer. He said he did not think any one who had not passed the chair could have any idea of the work undertaken by the Secretary. And when they had a Secretary who did it all with the greatest goodwill, tact, and discretion in the fullest sense, they possessed a man they could ill afford to lose. Mr. Bennett had not enjoyed the best of health during the past year, and for this they were all sorry; but he had prevailed upon him to continue to act for another year. Without him, he did not know what the Association would do.

Mr. C. F. BOTLEY (Hastings) said he supposed that, having recently passed the Chair, he was one of those who were qualified to speak in some way of the value of the Secretary. He would remind the members that the traditions of the secretaryship of the Association had been very high; and if he said that Mr. Bennett fully maintained these traditions, he could pay him no higher compliment. He felt from his personal experience that he did so; and he had great pleasure in seconding the proposition, because he was sure the Association's interests were safe in his hands, and that he would continue to give them the best of service.

The resolution was heartily passed by the members.

Mr. BENNETT said he was much obliged for all the kind things that had been said about him, and for the way in which the meeting had received the proposal. He had really felt that, acting under doctor's orders, he should give the office into better hands but even doctor's orders had to take second place when the General Committee of the Southern Association demanded that he should go on for another twelve months. So he had to turn the doctor down, and do what the Committee told him to; and he would have much pleasure in doing it.

### ELECTION OF NEW MEMBERS.

The following new members were then elected: Mr. George Helps, Gas-Works, Nuneaton; Mr. Hugh Hughes, Gas-Works, Melksham, Wilts.; and Mr. William Henry Read, M.Inst.M.E., Gas Offices, Bridport.

### PAPERS AND DISCUSSIONS.

The PRESIDENT said that now that all the formal business had been concluded, they could settle down to the consideration of the following two excellent papers.

"The Economic Aspect of Modern Carbonizing Methods, Exemplified by Results and Working Costs at the Portsmouth Gas-Works," by Mr. Thos. Carmichael, M.I.Mech.E., Portsmouth.

"The Electro Flow Meter," by Mr. John Terrace, of the South Suburban Gas Company.

The first of these papers, with a report of the discussion, will be found following this report. Extreme pressure on our columns compels us to hold-over Mr. Terrace's excellent contribution and our report of the discussion.

### CONCLUDING BUSINESS.

The PRESIDENT said that before closing the proceedings there was one little matter upon which he would like to have an expression of opinion. Last Saturday they were all pleased to notice that the "Gas World" had issued their 2000th number. He thought it would be rather gracious on the part of the Association if they were to write a letter to the proprietors congratulating them, and expressing the hope that they might live at least another forty years, to have a 4000th number.

This was agreed to.

The PRESIDENT then went on to mention that Mr. Carmichael had hoped for the presence with them that day of his Chairman, Mr. T. H. F. Lapthorn, but he was unfortunately unable to attend. They had, however, with them one of his colleagues, Mr. J. W. Gieve, whom they were pleased to welcome. They were also all delighted to see at the meeting Mr. Daniel Irving, of Bristol, and several other very old friends who had evidently been impressed with the importance of the papers.

### THANKS TO THE PRESIDENT.

Mr. W. E. PRICE (Hampton Wick) proposed a hearty vote of thanks to Mr. Campbell for the manner in which he had presided over the meeting, and also for what he had done to secure the very high-class papers they had just enjoyed.

Mr. C. H. RUTTER (Brighton), in seconding, remarked that Mr. Campbell had in every way been an excellent President.

The vote having been carried by acclamation,

The PRESIDENT briefly expressed his thanks, and said that he was amply rewarded for anything he might have done by the large attendance that day. This of itself spoke volumes, and he appreciated it very highly.

The members had tea together before separating.

# THE ECONOMIC ASPECT OF MODERN CARBONIZING METHODS.

## EXEMPLIFIED BY RESULTS AND WORKING COSTS AT THE PORTSMOUTH GAS-WORKS.

By THOMAS CARMICHAEL, M.Inst.Mech.E.

[A Paper Presented at the Annual General Meeting of the Southern Association of Gas Engineers and Managers, Nov. 23, 1922.]

The object of this paper is not only to bring within reasonable focus an illustration of the economic advantages derived from the adoption of modern carbonizing methods in the works of the writer, but also to induce a profitable discussion, and thus obtain the collective experience and judgment of the Association, which should be of value at this juncture of post-war reorganizations of plant. Having regard to a reminder that two decades have passed since a paper for any Gas Association has emanated from Portsmouth, it may be deemed permissible to submit a general description of our carbonizing units, and particularly to deal with any special features in their lay-out and construction. Probably members will consider the chief points of interest in this paper to be the description of the carbonizing installation erected last year, and the carbonizing results and working costs, together with comparative working results obtained from horizontal retorts worked with moderate charges, horizontals and blue water gas combined, and water-gas plant alone.

The gas supply of Portsmouth and district is manufactured at two separate stations—Hilsea and Flathouse. Particulars and statistics relating to the Portsea Island Gas Light Company (it is not generally known that Portsmouth is built on a comparatively small island) will be found in a booklet compiled last year as a souvenir of the centenary of the Company. Each member attending the present meeting is invited to accept a copy, upon perusal of which it will be felt that the record of steady progress of the local pioneers of gas lighting is a very creditable one.

### THE FLATHOUSE WORKS.

Flathouse—much the older of the manufacturing stations—occupies a site of about 3 acres, and is congested to its utmost capacity and incapable of expansion, by reason of its geographical situation in a triangle bounded by the National Dockyard and Portsmouth Harbour. Portions of the plant are quite ancient. There is no siding, the railway being somewhat remote. However, it has the considerable advantage, in its contiguity to the harbour, of being furnished with a private coaling berth. The coal used is entirely seaborne Durham.

The plant comprises ten beds of Woodall-Duckham vertical retorts of 5 tons per retort capacity, nine beds of nine horizontal retorts, and two 1 million c.ft. Humphreys & Glasgow water-gas sets. The vertical retorts were erected and put to work in 1916, and have this year been partially rebuilt in preparation for the present winter's load. The horizontal retorts, which are stoked by a Fiddes-Aldridge combined machine, were rebuilt during the summer of 1920, and are rendering highly satisfactory service with Durham coal. The water-gas plants were each originally of 650,000 c.ft. daily capacity, and last year were remodelled by the substitution of larger generators, gas-ways, &c., to give the same thermal yield at the lower calorific value. The existing washing and condensing plants were found large enough to deal with this make; but it was necessary to instal modern turbo-blowers in duplicate.

### THE HILSEA STATION.

The Hilsea station covers about ten times the area of the older works, and affords excellent scope for the lay-out and erection of new plant. The coal-gas manufacturing plant here consists of vertical retorts, which will be described later, and twenty beds of horizontal retorts, of similar design to those at Flathouse, but stoked by means of a Drake's projector machine. The coke from ten beds is dealt with by means of a De Brouwer hot-coke conveyor. The remaining ten beds are at present shut-down for conversion into beds of ten retorts each. The coke will be dealt with by means of a "G.N." hot-coke machine, erected by Messrs. Aldridge & Ranken, with outside quenching bench and suitable extension to the present telpher track. These horizontal retorts are erected on the site of the original inclined settings, and are therefore only 17 ft. 6 in. in length. There are also two carburetted water-gas plants, each of a daily capacity of 1 million c.ft.

### EXTENSIONS—SYSTEM OF CARBONIZATION.

During the period of the war, through circumstances beyond the control of the Company, the major portion of the manufacturing plant fell into a bad state of repair, and was deemed totally inadequate to meet the anticipated demand of the period of industrial activity consequent upon the declaration of peace. It was of vital importance that extensions of the carbonizing plant should be immediately taken in hand. During the winter of 1920-21, the Company had not a single spare unit of plant upon which to fall back in case of emergency. It was obvious that the new extensions must be carried out at Hilsea, owing to considerations of space, and also because these works are connected with the railway, while seaborne coal can easily be transported from Flathouse by road wagons.

The question of extensions was accordingly carefully gone into during the summer and autumn of 1919, and it was ultimately decided that the new plant should be vertical retorts. This decision was reached after full consideration of all the circumstances; the chief factor (1) being, of course, the necessity of manufacturing a suitable product at the lowest possible cost and with the greatest possible all-round efficiency, also taking into account the following, among other considerations: (2) Costs and conditions of labour. (3) Class of coal which may be carbonized, and which it might reasonably be hoped to obtain regularly. (4) The quality of coke required for local consumption.

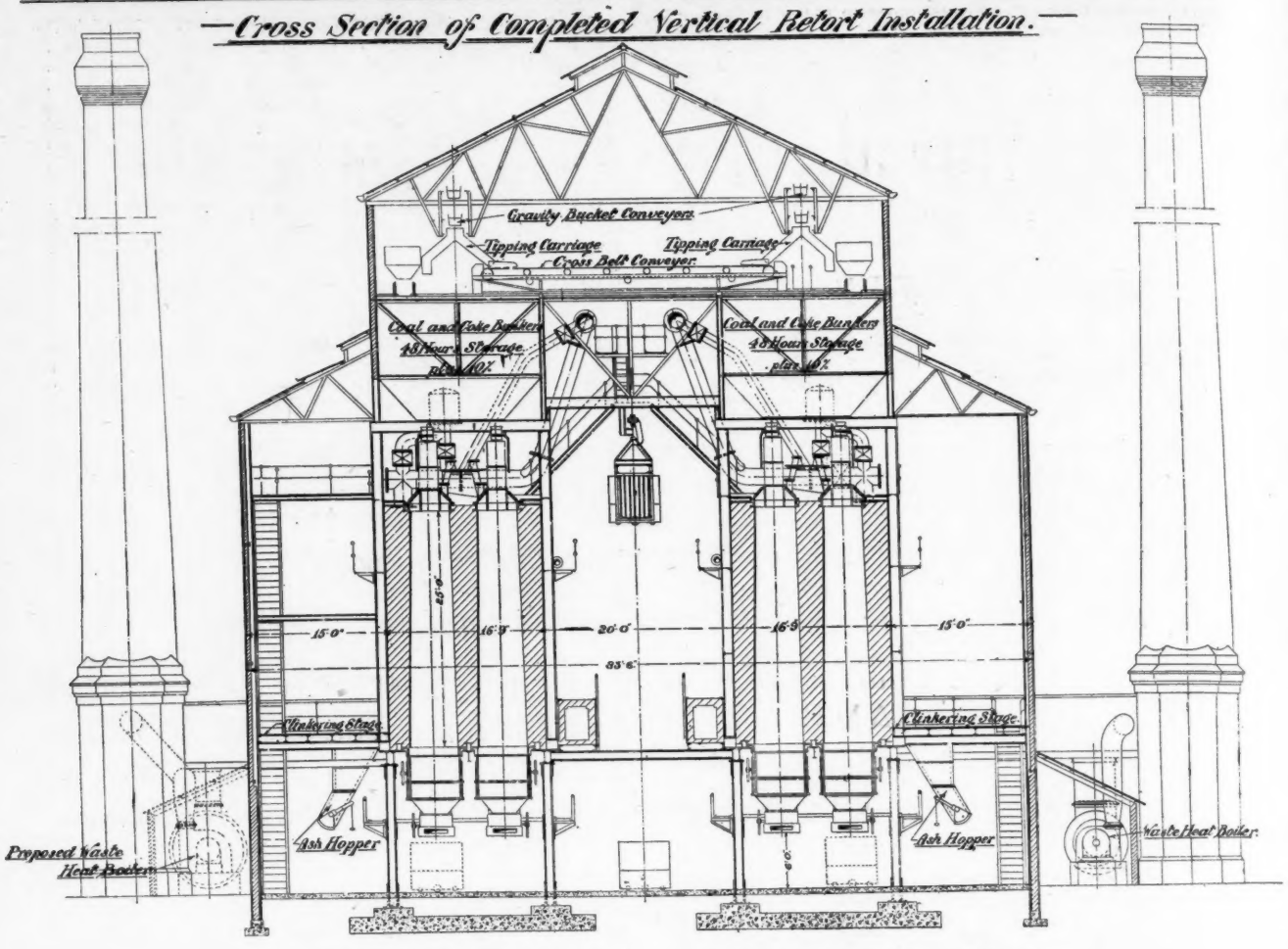
(1.) The first consideration really resolved into the thermal yield of the plant per ton of coal, when making a gas suitable for efficient distribution and consumption. This point will be dealt with later, and it is only necessary to add that the choice was very largely determined by the results guaranteed on certain specified coals by various contractors. The writer has the permission of Sir Arthur Duckham to publish the actual details of the guarantees, which are given in an appendix to this paper.

(2.) Costs and conditions of labour. It is most essential that the new plant should be worked at the minimum expense under this heading. Labour costs were at that time a very serious item in all manufacturing costs, and the slightest possibility of reducing expense under this head was taken advantage of. This point was also covered in the tenders received in response to the Company's specification.

(3.) The class of coal to be carbonized presented a more difficult problem. Only Durham coal had been carbonized in the existing verticals, and our experience had on the whole been rather unfortunate. At Flathouse we were limited entirely to seaborne Durham; and it was there found that, though such coal gave excellent results and a very good coke in horizontal retorts, it was nevertheless unsuitable for efficient use in continuous verticals. The throughput of the latter was very seriously reduced (often 3¼ to 3½ tons per day, instead of the normal 5 tons); extra labour was required for rodding, through the frequent

## PORTSEA ISLAND GAS LIGHT COMPANY — HILSEA WORKS

*Cross Section of Completed Vertical Retort Installation.*




*Cross Section of Existing Plant.* *Cross Section of Future Extension.*

*Scale of Feet.*

hanging-up of the charge; it was also found that no improvement in the yield was to be obtained from "steaming," since the throughput was thereby still further reduced; and finally there was seriously increased wear and tear on the retorts themselves, as a result of the foregoing factors. After going carefully into the whole matter, it was found that sufficient Midlands coal could be brought by rail to Hilsea sidings to serve the proposed plant; and as far as could be seen, there was every likelihood of this supply being available in the future. It was known that such coal gave good results in verticals; and high guarantees (afterwards exceeded) were given for them—see appendix.

(4.) Quality of coke. Portsmouth is not mainly an industrial district, and the great bulk of the local sales of coke go for domestic use, or for bakeries, laundries, &c. It is therefore essential to place on the market a fairly hard, dry coke, of good appearance and burning qualities. In fact, trouble has occasionally been experienced in the past through consignments of wet or partly burnt-off coke from horizontal retorts having found their way into the town. It was felt that vertical retorts offered distinct advantages in this respect, as in the other items enumerated.

### New Plant—Hilsea.

As already stated, vertical retorts of the latest design were decided upon, and it was at first intended to put down a plant of 3 million c.ft. daily capacity. In view, however, of the high capital cost of such an installation, and the possibility in the near future of shutting-down some of our existing plant for enlargement and reconstruction, it was felt that one-half of this proposed installation should be proceeded with. Making adequate allowance for scurfing, seven beds of continuous vertical retorts were put down alongside the existing horizontal house. The retort-house is of steel-frame construction, panelled with 4½ in. brickwork; and the house wall on the regenerator side, together with the cross joists at the eaves and other details of construction, are so arranged that the stanchions may be removed therefrom and carried back in such a way as to double the size of the house upon the erection of a further seven beds parallel with the present bench. The telpher track inside the retort-house will then be on the centre line of the complete house of fourteen beds of retorts.

### Coal-Handling Plant.

Coal is brought to the stores at the back of the old horizontal house by means of elevated sidings; and two of these were very easily and cheaply extended, in the form of a steel girder gantry, on brick piers, to accommodate wagons of coal for the new installation. Wagons are shunted by the Company's locomotives on the inclined gantry, and then run down as required into a rotary wagon tipper, driven and clamped by electric motors. The coal is thereby tipped into a steel receiving hopper, and passes through a jigging screen, crusher, and rotary filler, into the buckets of a gravity bucket conveyor, in which it is elevated to the hopper level and tipped into the storage hoppers by a travelling tipping carriage. The coke for the producers is stored inside the retort-house in a steel hopper, which is filled by the telpher machine; and from this hopper the coke issues through a jigging screen into a receiving hopper beneath the tipper. The coal crusher is by-passed, and the coke enters the filler of the gravity bucket conveyor, by which means it is elevated to the hoppers. An electric hoist in the opposite corner of the house provides a stand-by for the conveyor and a means of access to the various stage levels.

### Settings.

The retorts, arranged in beds of four, are of the 5-ton size, and the settings are of the Woodall-Duckham Company's latest design, which is no doubt familiar to most of the members. The lower waste-gas flues are provided with superheaters for the steam, which is afterwards admitted into the retort through firebrick nostrils at the producer stage level. A secondary combustion chamber is also provided, in order to assist steaming by extending the zone of maximum temperature towards the bottom of the retort; but this has not yet been used.

The coke from the retorts is discharged into bottom-opening telpher skips of 2-tons capacity, which are afterwards pushed-out on rollers and inclined skipways to a point beneath the telpher track, and there hoisted. One skip takes the coke from four retorts every two hours. The telpher plant has been so arranged

that the whole of the coke, breeze, and ashes in connection with the vertical and horizontal retorts, water-gas plant, and boiler-house may be dealt with by one man per shift. The track rail is 49 ft. 9¼ in. above datum; and the total length of the track, when present extensions are completed, will be 1610 ft. The whole plant is electrically driven on direct current at 440 volts, generated by two 99 H.P. "National" gas-engines and Lancashire Dynamo Company's generators.

### Working Results from Vertical Retorts.

This new plant was put to work in 1921; and the heating-up, starting, and subsequent working have been carried out without the slightest hitch. The plant has been worked throughout on Derbyshire coals, which are found to give no trouble in the retorts, as well as a very satisfactory throughput per retort and per man, and high thermal yield. It is unfortunately impossible to give with any degree of accuracy results of the fifteen months' working, since the gas from this plant has, of necessity, at certain periods been mixed with that from the other sections. Some weeks after the plant had been put to work, however, the gas from it was completely isolated, and a full 28-days' guarantee test was run under the strictest supervision and with the greatest possible accuracy; and it is upon these figures obtained by the author's assistants, in conjunction with Messrs. Woodall-Duckham's staff, that the following results and costs are based—figures which are being maintained and frequently exceeded.

Table I. gives the results obtained, the figures in each case being an actual average over 28 consecutive days. This table is more or less self-explanatory, but the following observations may be added.

The coal carbonized was entirely Derbyshire, and the mixture was fairly constant, being limited to three particular coals. Approximately 80 p.ct. of the whole was washed nuts (1⅛ in. to 1¼ in.), the remainder being mostly screened gas coal. The analysis of the coal was as follows, the percentages being given on the wet basis:

| | P.Ct. |
|---|---|
| Moisture | 6·57 |
| Ash | 7·84 |
| Volatile matter | 32·1 |
| Sulphur | 2·38 |

As regards the plant, all the 28 retorts were kept working by means of extra scurfing immediately preceding the test.

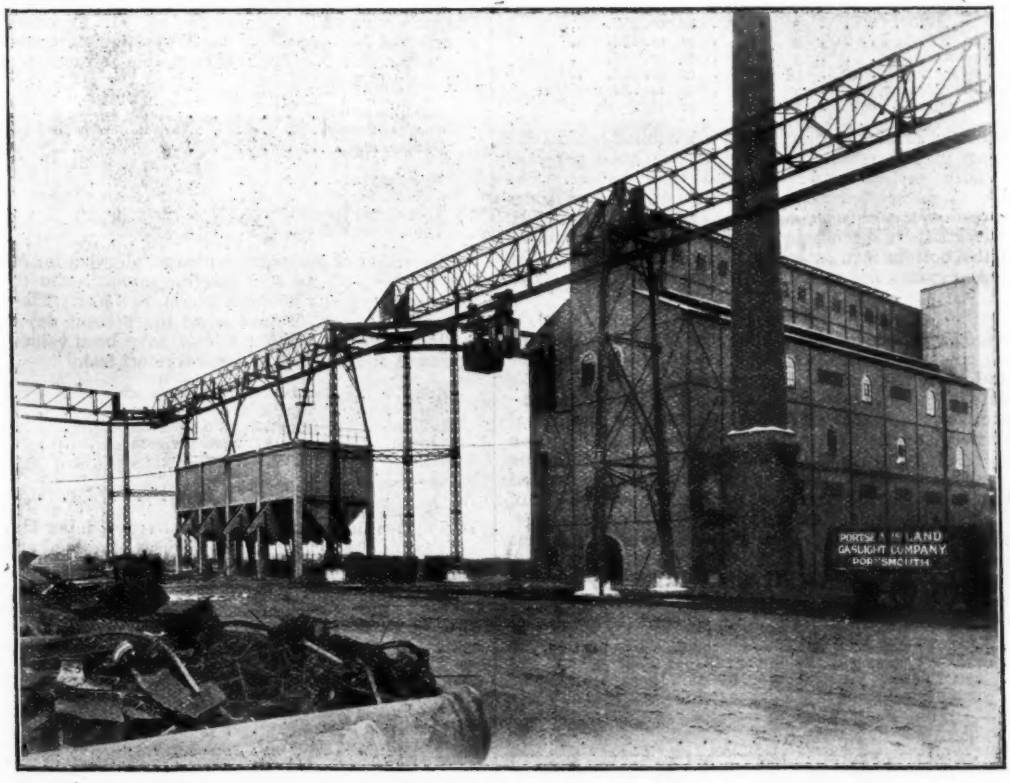
Observations of pull, temperatures, steam pressures, &c., were taken every two hours. The retorts were steamed at a pressure of 29½ lbs. average throughout the period, and the steam admitted represented 16 to 18 p.ct. of the weight of the coal carbonized. This amount of steam would no doubt have been exceeded but for the fact that our specification (extracts from which are given in the appendix) called for a gas of 460 B.Th.U. gross. In this connection, it will be noted from the gas analysis that a slight excess of air was added before condensing. The isolating of the various sections of the works caused a little purifier trouble, to cure which this air had to be admitted. It was therefore impracticable to steam the retorts to any greater extent.

The coal carbonized was weighed in railway trucks, and the gross and tare weights carefully checked. All coke used for fuel was similarly weighed, as was all the pan ash taken from the shoots below the producer doors. The coal carbonized, coke and ashes made, fuel used, &c., were sampled in large bins, average samples being made up and analyzed each day. The analyses of these materials, as well as the calorific value determinations, records of make, &c., were taken by the Company's chemists, while the station meter used was checked by the makers' representatives before and after the test, and found correct. The purified gas

Table I.—*Results of Guarantee Tests on Vertical Retorts.*

*Hilsea Works.*

| | | |
|---|---|---|
| **Plant and Conditions.** | | |
| Duration of test | days | 28 |
| Retorts at work | | 28 |
| Pull at inlet retort-house governor | tenths | 1 |
| Pressure on tops of retorts | ,, | 0 |
| Temperature at outlet retort-house governor | Fahr. | 225 |
| Combustion chamber temperature | °C. | 1216 |
| Main flue temperature | °C. | 525 |
| Chimney pull | tenths | 9 |
| Steam pressure on retorts | lbs. per sq. in. | 29½ |
| **Coal.** | | |
| Tons carbonized, actual | | 3218·5 |
| Throughput, tons per retort per day | | 4·11 |
| Throughput, tons per man per day | | 6·76 |
| **Gas.** | | |
| Actual make | c.ft. | 53,280,000 |
| Temperature and pressure correction factor | | 1·044 |
| Make, corrected to 60° Fahr. and 30 in. (moist) | | 55,637,000 |
| Make per ton, actual | | 16,560 |
| Make per ton, corrected | | 17,290 |
| Calorific value (average of collected samples) | | 464·7 |
| Multiple, therms, per ton of coal as received | | 80·35 |
| ,, therms per ton of coal (dry basis) | | 86·02 |
| ,, therms per ton of coal (dry and ash-free) | | 93·86 |
| **Gas Analysis.** | | |
| Percentage of $CO_2$ | | 4·9 |
| ,, $O_2$ | | 0·8 |
| ,, $C_nH_m$ | | 2·0 |
| ,, CO | | 14·1 |
| ,, $CH_4$ | | 22·6 |
| ,, $H_2$ | | 45·1 |
| ,, $N_2$ | | 10·5 |
| Calorific value, calculated from analysis | | 462·6 |
| Calorific value, average of "spot" tests | | 464·9 |
| Specific gravity of gas | | 0·509 |
| **Impurities.** | | |
| $H_2S$ at tar extractor | p.ct. | 1·7 |
| Sulphur in purified gas | grains per 100 c.ft. | 38·0 |
| Naphthalene | ,, ,, ,, | 6·0 |
| Cyanogen at tar extractor. Lbs. $Na_4FeC_6N_6\ 10H_2O$ per 10,000 c.ft. | | 3·3 |




TELPHER PLANT, COKE BUNKERS, AND VERTICAL RETORT-HOUSE.

COKE MADE.

| | | |
|---|---|---|
| Tons (vertical retort test-plant results—steamed) | | 2108 |
| Coke and breeze made | cwt. per ton | 13·1 |
| Actual analysis (wet basis) | p.ct. moisture | 7·1 |
| | p.ct. ash | 15·2 |
| | p.ct. volatile matter | 1·2 |
| | p.ct. sulphur | 2·2 |
| Percentage of breeze in total | | 14·2 |

FUEL USED.

| | | |
|---|---|---|
| Actual fuel used in producers | tons | 434·4 |
| Fuel used in producers, lbs. per 100 lbs. of coal | | 13·5 |
| Fuel used in producers | cwt. per ton | 2·7 |
| ,, ,, ,, dry | ,, ,, | 2·5 |
| Breeze for steam raising | ,, ,, | 0·9 |

COKE AND BREEZE FOR SALE.

| | | |
|---|---|---|
| Total calculated from above | cwt. per ton | 9·5 |
| Coke for sale, calculated from above | ,, ,, | 9·0 |
| Breeze for sale, ,, ,, ,, | ,, ,, | 0·5 |

PAN ASHES.

| | | |
|---|---|---|
| Actual tons made | | 52·4 |
| Analysis: Moisture, p.ct. | | 8·3 |
| Incombustible matter, p.ct. wet basis | | 82·2 |

was not only tested by the usual "spot" tests, but two eleven-hour samples were collected each day and tested for calorific value, gas analysis, specific gravity, &c. The calorific value of the gas was very constant. A further notable feature about the test is the very close agreement between the average calorific values of collected samples, "spot" tests, and the figure calculated from the gas analysis.

It was unfortunately impossible to obtain the accurate weight of coke made, owing to lack of facilities for direct weighing. The analysis and percentage of breeze, &c., given in the table are test figures, and the amount of coke and breeze made for sale has been calculated back from the make of coke obtained on our vertical retort testing plant under actual steaming conditions. These results will be discussed later.

LABOUR ON VERTICALS.

It is intended in the present paper to give the labour costs (from coal wagon to coke hopper) for the various carbonizing methods, which may be strictly comparative among themselves, and at the same time to give sufficient detail as to labour employed, rates of pay, &c., to make these figures as useful as possible when compared with those obtained at other works. Many figures for working results published from time to time are unfortunately useless in this respect, because the duties of the men included in the cost, or their rates of pay, are very rarely clearly specified. Current rates have been used throughout, and the figures arrived at are given in Table II.

The labour employed per 24 hours on the vertical retorts during the guarantee test quoted above—and, in fact, since that date—is as follows:

| | | | |
|---|---|---|---|
| Leading hand | 1½ | at 11s. 7½d. | per shift |
| Elevator attendant | 1 | at 9s. 7½d. | ,, |
| ,, assistant | 1 | at 9s. 1d. | ,, |
| Topmen | 3 | at 10s. 7½d. | ,, |
| Bottom men | 3 | at 9s. 6½d. | ,, |
| Stepgrate men | 3 | at 9s. 7½d. | ,, |
| Telpher driver | 1½ | at 9s. 7½d. | ,, |
| Scurfing, flue cleaning, &c. | 2 | at 1s. 1½d. | per hour |
| Pipes, seals, and odd work | 1 | at 1s. 0·34d. | ,, |

It will be noted that 1½ leading hands are debited against the vertical plant, for the reason that one leading hand per shift supervises both vertical and horizontal retort-houses. The same applies to the telpher driver, in which case one man per shift serves vertical house, water-gas plant, and boiler-house. The telpher driver assists in discharging the coke and pushing out the skips, and the bottom men attend to the extractor seals. The above represent 17 men per 24 hours, at a total cost of £8 7s. 11¼d.

COST OF PRODUCTION.

The above figures, both for carbonizing results and labour costs, are given in column 1 of Table II., and are applicable when the whole of the seven beds are at work, as was the case during the test. In actual working, however, it is found necessary to have an average of 10 p.ct. of the retorts out of action for scurfing, at which times the plant may be assumed to give 90 p.ct. of the above output, while employing the same labour. We may therefore take the production under ordinary working conditions, corrected to normal temperature and pressure, as 1,788,000 c.ft. of gas of 465 B.Th.U. per 24 hours. This is equivalent to a daily production of 8310 therms from 103·5 tons of raw coal, or 80·4 therms per ton (see column 2).

To arrive at the total cost of production, the quantity and value of the residuals may be taken to-day at the following figures per ton of coal:

| | | | |
|---|---|---|---|
| Coke | 9 cwt. | at 27s. 6d. per ton | 12s. 4½d. |
| Tar | 15 galls. | at 4d. per gall. | 5s. |
| Breeze | ½ cwt. | at 7s. 6d. per ton. | 2¼d. |
| Liquor | 35 galls. 10 oz. | at 30s. per 1000 | 1s. 0½d. |
| | | Total | 18s. 7½d. |

The Derbyshire coals purchased for this installation cost at the present day 32s. per ton (average), making the net cost of coal—*i.e.*, coal less residuals—13s. 4¾d. per ton.

On this basis (usual working conditions), the total cost—net coal and labour—of gas manufactured in our new vertical plant is as follows:

| Item. | Per Ton of Coal. | Per 1000 C.Ft. | Per Therm. |
|---|---|---|---|
| | s. d. | d. | d. |
| Net coal | 13 4·75 | 9·30 | 2·00 |
| Labour cost | 1 7·5 | 1·12 | 0·24 |
| Total cost | 15 0·25 | 10·42 | 2·24 |

In comparison with our general working, which is indicated in Table III., the foregoing figures may be compared with the average costs at both works for each of the four quarters of the past twelve months, as given later. It will there be noted that the quality was maintained through this period at 450 to 460 B.Th.U. Though this calorific value is being maintained for the present, it may be stated here that, in order to be able to carry out regular experiments for the most economical quality of gas to manufacture and the method of operation, we have isolated one of our new vertical retorts for testing purposes; and in connection with it a separate exhauster, purifying plant, meter, and holder have been installed.

In comparison with the figures given above, we have also worked out similar figures for other conditions of working. In columns 3 and 4 of Table II. the costs have been included for working six beds on Derbyshire coal without steaming, and also six beds on Durham coal without steaming. Six beds have been taken, since more scurfing would be required, and it has been assumed that the labour would be as above in the former case. The number of men required by the contractors' guarantee has been allowed for the Durham coal, though our experience at Flathouse on the older plant indicates that still more labour per diem would be necessary when carbonizing the latter coal.

The results in these cases are not obtained from actual working, but are based on guarantees of the contractors for these particular conditions. The cost given per therm for Durham coal is from our experience too low; the actual cost at Flathouse over a very long period being in the neighbourhood of the Derbyshire figure of 2·81d. (column 3). It will be seen that the use of Durham coal would result in a higher cost per therm, and reduce the thermal output of the plant by nearly 25 p.ct. The use of Derbyshire coal without steaming would only slightly reduce the thermal output; but the cost of the therm would be considerably higher, owing principally to the higher initial cost of this class of coal, and to the smaller yield of residuals per ton.

COST OF WORKING HORIZONTAL RETORTS (FLATHOUSE).

In order to obtain comparative results, opportunity was taken in the early part of this year to carry out a 28-days' test on horizontal retorts worked with Fiddes-Aldridge machinery on Durham coal (not a quality known as "Wear Specials"). The retort-house chosen was that at Flathouse, consisting of nine beds of nine's, each 20 ft. long by 24 in. by 16 in. ⌂ section, since these retorts had been re-set during the preceding summer, and were in good condition. The results of this test, corrected to N.T.P., were as follows:

| | |
|---|---|
| Duration of test | 28 days |
| Coal carbonized | 2414 tons = 86·2 tons per diem |
| Gas made | 31,503,000 c.ft. = 1,125,000 c.ft. per diem. |
| Make per ton | 13,050 c.ft. |
| Calorific value | 515 B.Th.U. gross |
| Therms per ton | 67·2 |
| Therms per diem | 5793 |

The weight of the average charge, allowing for retorts scurfed, was 10·9 cwt. of raw coal, and the impurities in the coal were: Moisture, 1·7 p.ct.; ash (wet basis), 10·8 p.ct. The average cost of the coal in this instance is, at the present day, 27s. 10½d. per ton into store; and the residuals have been valued at the same figures as adopted for the vertical retort test.

| | | | |
|---|---|---|---|
| Coke | 9 cwt. at 27s. 6d. per ton | | 12s. 4½d. |
| Tar | 10 galls. at 4d. per gallon | | 3s. 4d. |
| Breeze | 1½ cwt. at 7s. 6d. per ton | | 6d. |
| Liquor | 21 galls. at 30s. per 1000 | | 7½d. |
| | | Total | 16s. 10d. |

This makes the net cost of the coal 11s. 0½d. per ton.

As in the case of the Hilsea works, 1½ leading hands and 1½ telpher drivers per 24 hours are debited against this retort-house, the coke from which is dropped into skips, which are then pushed out under quenchers to a point under the telpher track. The retorts were worked on twelve-hour charges, and the men engaged in three eight-hour shifts per 24 hours were as follows:

| | | | |
|---|---|---|---|
| Leading hands | 1½ | at 11s. 7½d. | per shift |
| Machine men | 3 | at 10s. 7½d. | ,, |
| Stokers and firemen | 8 | at 10s. 0½d. | ,, |
| Coal and coke wheelers | 7 | at 9s. 1d. | ,, |
| Coal conveyor attendant | 1 | at 9s. 7½d. | ,, |
| Telpher | 1½ | at 9s. 7½d. | ,, |
| Scurfing | 1 | at 1s. 2d. | per hour |

This gives a total of 23 men per day, at a cost of £11 7s. 6d.

TABLE II.—*Cost of Gas (Carbonizing Only) from Various Plants.*

**Based on Current Prices and Rates of Wages. November, 1922.**

| SYSTEM OF CARBONIZATION. | WOODALL-DUCKHAM VERTICALS. | | | | HORIZONTALS WITH MACHINERY. | | | BLUE WATER GAS. | | | CARBURETTED WATER GAS. | | | MIXTURE. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WORKS | HILSEA. | HILSEA. | HILSEA. | HILSEA. | FLATHOUSE. | HILSEA. | HILSEA. | FLATHOUSE. | FLATHOUSE. | HILSEA. | FLATHOUSE. | FLATHOUSE. | FLATHOUSE. | FLATHOUSE. |
| Plant and Conditions | 7 Beds on Derbyshire Coal Steamed. | 7 Beds on Derbyshire Coal Steamed, less 10 p.ct. Scurfing. | 6 Beds on Derbyshire Coal, No Steam. | 6 Beds on Durham Coal, No Steam. | 9 Beds on Durham Coal. | 20 Beds on Durham, after Reconstruction. | Proposed new Bench of 10 Beds on Durham. | 1 Set. | 2 Sets. | 2 Sets. | 1 Set at 465 B.Th.U. | 2 Sets at 465 B.Th.U. | 2 Sets at 400 B.Th.U. | Coal Gas and Blue at 465 B.Th.U. |
| Coal carbonized, per 24 hours . . . tons | 115 | 103·5 | 126 | 96 | 86·2 | 232 | 179·5 | .. | .. | .. | .. | .. | .. | .. |
| Gas made, c.ft. per 24 hours . . . N.T.P. | 1,987,000 | 1,788,000 | 1,512,000 | 1,248,000 | 1,125,000 | 2,934,500 | 2,271,000 | 870,000 | 1,740,000 | 1,700,000 | 980,000 | 1,960,000 | 1,800,000 | .. |
| Gas made, c.ft. per ton . . . . . N.T.P. | 17,290 | 17,290 | 12,000 | 13,000 | 13,050 | 12,650 | 12,650 | .. | .. | .. | .. | .. | .. | .. |
| Calorific value, gross . . . . . | 465 | 465 | 510 | 510 | 515 | 530 | 530 | 303 | 303 | 303 | 465 | 465 | 400 | 465 |
| Therms per 24 hours . . . . . | 9,240 | 8,310 | 7,711 | 6,365 | 5,793 | 15,550 | 12,030 | 2,636 | 5,272 | 5,151 | 4,557 | 9,114 | 7,200 | .. |
| Therms per ton raw coal . . . . . | 80·4 | 80·4 | 61·2 | 66·3 | 67·2 | 67 0 | 67·0 | .. | .. | .. | .. | .. | .. | .. |
| Men employed per 24 hours . . . . . | 17 | 17 | 17 | 23 | 23 | 30 | 21 | 12 | 18 | 15 | 12 | 21 | 21 | .. |
| Cost of labour per 24 hours . . . . | £8 7 11¼ | £8 7 11¼ | £8 7 11¼ | £11 11 9¾ | £11 7 6 | £14 13 3 | £10 12 9½ | £5 18 1 | £8 15 2 | £7 11 5 | £5 18 1 | £10 6 4 | £10 6 4 | .. |
| Therms per man . . . . . | 544 | 489 | 454 | 277 | 252 | 518 | 573 | 220 | 293 | 343 | 380 | 434 | 343 | 262 |
| Cost of material less residuals— | | | | | | | | | | | | | | |
| Per ton . . . . . s. d. | 13/4·75 | 13/4·75 | 13/0 | 10/8 | 11/0·5 | 12/2 | 12/2 | .. | .. | .. | .. | .. | .. | .. |
| Per 1000 . . . . . d. | 9·30 | 9·30 | 13·0 | 9·85 | 10·15 | 11·54 | 11·54 | 7 24 | 6 98 | 6·98 | 15·80 | 15·57 | 12·42 | .. |
| Per therm . . . . . d. | 2·00 | 2·00 | 2·55 | 1·93 | 1·97 | 2·18 | 2·18 | 2·39 | 2·30 | 2 30 | 3·40 | 3·35 | 3·11 | .. |
| Cost of labour— | | | | | | | | | | | | | | |
| Per ton . . . . . s. d. | 1/5·5 | 1/7·5 | 1/4·0 | 2/5·0 | 2/7·7 | 1/3·2 | 1/2·2 | .. | .. | .. | .. | .. | .. | .. |
| Per 1000 . . . . . d. | 1·01 | 1·12 | 1·33 | 2·23 | 2·43 | 1·20 | 1·12 | 1·63 | 1·21 | 1·07 | 1·45 | 1·26 | 1·38 | .. |
| Per therm . . . . . d. | 0·22 | 0·24 | 0·26 | 0·44 | 0·47 | 0·23 | 0·21 | 0·54 | 0·40 | 0·35 | 0·31 | 0·27 | 0·34 | .. |
| Total cost— | | | | | | | | | | | | | | |
| Per ton . . . . . s. d. | 14/10·25 | 15/0·25 | 14/4·0 | 13/1·0 | 13/8·2 | 13/5·2 | 13/4·2 | .. | .. | .. | .. | .. | .. | .. |
| Per 1000 . . . . . d. | 10·31 | 10·42 | 14·33 | 12·08 | 12·58 | 12·74 | 12·66 | 8·87 | 8·19 | 8·05 | 17·25 | 16·83 | 13·80 | 11·64 |
| Per therm . . . . . d. | 2·22 | 2·24 | 2·81 | 2·37 | 2·44 | 2·41 | 2·39 | 2·93 | 2·70 | 2·65 | 3·71 | 3·62 | 3·45 | 2·50 |
| Actual or estimated . . . . . | Actual | Calculated from 1 | Estimated | Estimated | Actual | Estimated | Estimated | Actual | Actual | Actual | Actual | Calculated from 11 | Estimated | Calculated from 5 and 9 |
| Remarks . . . . . | 28-day guarantee test results | Usual working conditions | | | Results of 28 days' test | After completion of reconstruction | | Guarantee test results | Guarantee test results | | Guarantee results 1·8 galls. of Oil per 1000 c.ft.; 90 B.Th.U. and 63 c.ft. per gall. of oil | | 1·08 galls. of oil per 1000 c.ft. | 76·5 p.ct. horizontal gas at 515; 23·5 p.ct. blue at 303 |
| Column number . . . . . | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |

The cost of production of coal gas in this house, as given in column 5 of the table, works-out on this basis as follows:

| Item. | Per Ton of Coal. | Per 1000 C.Ft. | Per Therm. |
|---|---|---|---|
| | s. d. | d. | d. |
| Net coal. . . . . | 11 0·5 | 10·15 | 1·97 |
| Labour cost . . . | 2 7·7 | 2·43 | 0·47 |
| Total cost . . . . | 13 8·2 | 12·58 | 2·44 |

No figures are given in the table for coal gas from the horizontal retorts at Hilsea works, owing to the absence of any reliable test figures; but it may be noted that the approximate cost taken out exceeds the above by a very small fraction of a penny per therm.

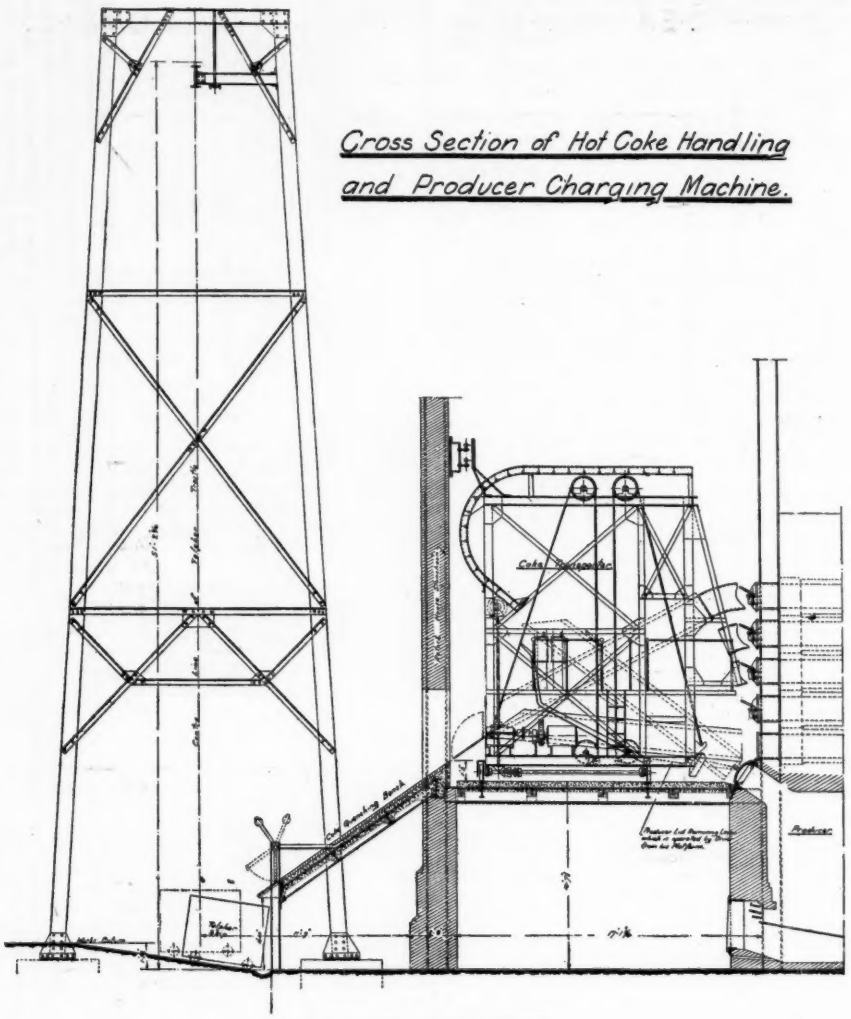
When the present reconstructions are completed, including the conversion of beds of nine's into beds of ten's, and the addition of a coke-handling machine, quenching bench, and telpher extension, it is estimated that the cost of gas produced from Durham coal in the Hilsea horizontal house will be slightly over 2·4d. per therm (see column 6).

### PROPOSED NEW HORIZONTAL HOUSE.

Capital costs have been estimated, and will be discussed later, for the construction of an entirely new retort-house of ten beds of ten horizontal retorts, each 23 ft. long, provided with stoking machinery to give at least 18½ cwt. per charge, and with coke-handling machine, telpher, &c., as before. The results which may be expected from such a house are given in column 7 of the table, from which it will be seen that the heavy charges and long retorts on twelve-hour work give a very low labour cost per therm, or, in other words, a very high thermal yield per man. The cost of gas on the same basis is estimated at 2·39d. per therm.

### BLUE WATER GAS.

Blue water gas is one of the oldest diluents for coal gas, and the subject of blue water gas dilution is of special interest because it provides a means of gasifying a larger proportion of the coal. As, for reasons explained later, we work to 450 B.Th.U.




G.N. COKE TRANSPORTER.

declared calorific standard, the coal gas produced in horizontals or in verticals, without steaming, must of necessity be diluted before distribution; and the cost of blue water gas manufactured in a separate generator therefore becomes of importance. In order to arrive at this, actual test figures have been taken, and are given in columns 8 and 9 of the table referring to water gas plant at our Flathouse works. They were obtained during the guarantee tests carried out under our supervision, after the older sets had been remodelled and enlarged.

The total gas actually made averaged 870,000 c.ft. per generator per diem, of a calorific value of 303 B.Th.U. gross, representing a daily thermal production of 2636 therms per generator. The cycle of operations adopted, during and since the test, was two minutes' "blow" and four minutes' "run," one run in four being a down run.

The materials used per day when working two sets are

| | £ | s. | d. |
|---|---|---|---|
| Coke to generators, 30 tons at 27s. 6d. per ton . . | 41 | 5 | 0 |
| Breeze to boilers, 25 tons at 7s. 6d. per ton . . . | 9 | 7 | 6 |
| Total . . . . . | £50 | 12 | 6 |

or, for one set:

| | £ | s. | d. |
|---|---|---|---|
| Coke to generator, 15 tons at 27s. 6d. per ton . . | 20 | 12 | 6 |
| Breeze to boilers, 15 tons at 7s. 6d. per ton . . . | 5 | 12 | 6 |
| Total . . . . . | £26 | 5 | 0 |

The labour for 24 hours on this plant is as follows:

| — | Two Sets. | One Set. | Rate. s. | d. |
|---|---|---|---|---|
| Operators . . . . . | 3 | 3 | 10 | 4½ |
| Firemen . . . . . | 6 | 3 | 9 | 11½ |
| Boilermen . . . . . | 3 | 3 | 9 | 11½ |
| Coke wheelers . . . . . | 6 | 3 | 9 | 1 |

This gives a total labour charge per 24 hours of £8 15s. 2d. for two sets, or £5 18s. 1d. for one set. It will be noted that no engine drivers or exhauster attendants are included; and the reason for this is that the firemen attend to the exhausters, blowers, pumps, &c., between the clinkering periods. It will also be noted that one operator per shift works two generators when the latter are on blue gas.

The total cost of blue gas is therefore, as shown in detail in the foregoing table, 2·70d. per therm when working two sets, and 2·93d. per therm when only one set is working. These are actual test figures.

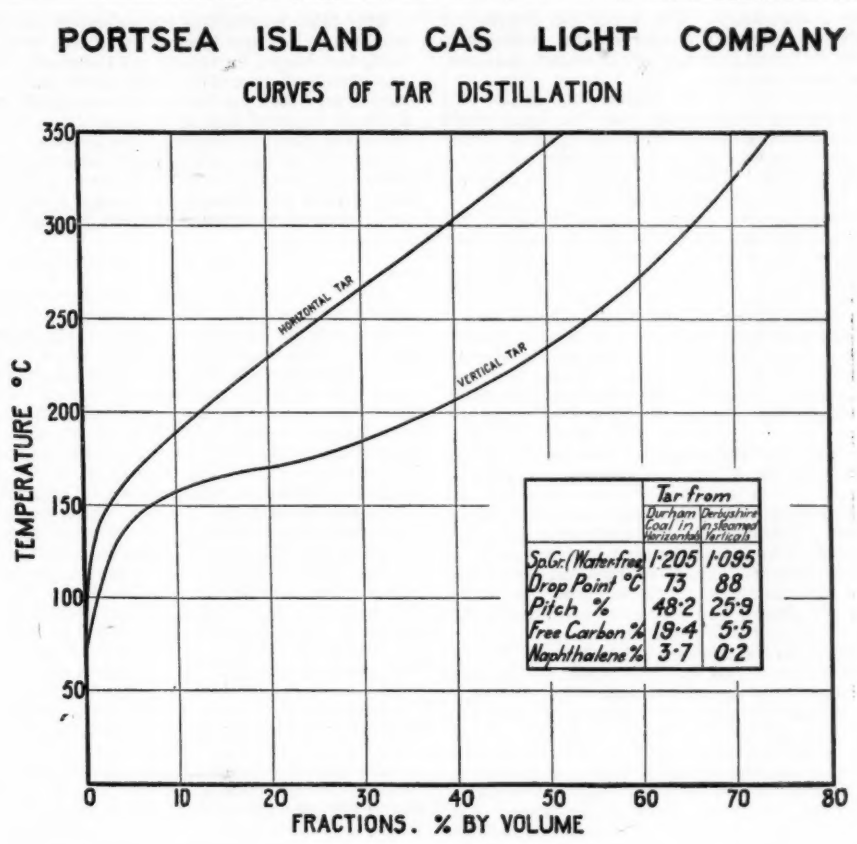
The Hilsea figures corresponding with the above are slightly lower, owing to economy effected by telpher coke handling; and the figure is 2·65d. per therm when two sets are worked. (See column 10).

These figures serve to indicate that, under present conditions and prices, blue water gas at Portsmouth, though costing less per 1000 c.ft., costs slightly more per therm than coal gas produced in horizontal or vertical retorts without steaming, and still more than mixed coal gas and water gas produced by steaming in vertical retorts.

On the above basis a mixture of 465 B.Th.U., composed of 76·5 p.ct. coal gas from horizontal retorts at 515 B.Th.U. and 23·5 p.ct. blue gas at 303 B.Th.U., could not be produced at less cost than 2·50d. per therm (column 14), compared with 2·24d. per therm for the same quality of mixed gas produced by steaming Derbyshire coal in vertical retorts.

### CARBURETTED WATER GAS.

One can hardly leave modern methods of manufacture without reference to that of carburetted water gas. Owing to the somewhat poor coke market, it is essential to manufacture water gas at Portsmouth, and it is equally essential, in order to maintain our standard quality, to enrich a portion of this water gas with gas oil. The cost of such enriched gas, therefore, is important; and similar guaranteed tests on carburetted gas being available for the remodelled Flathouse plant, corresponding figures have been worked-out and are included in the table. The results of the tests show that 980,000 c.ft. of 465 B.Th.U. gas, or a total of 4557 therms, could be produced per 24 hours from one generator. Taking the calorific value of blue gas as 303 (the figure found on blue tests), a duty of 90 B.Th.U. per gallon of oil was obtained. Thus, to obtain 465 B.Th.U. finished gas, it is necessary to use 1·8 gallons of oil per 1000 c.ft., and this gives an increase in gas volume of about 63 c.ft. per gallon of oil. The cycle was 1½ min. blow, and 4½ min. run, with one down run in four.




The coke and breeze used were practically the same as when making blue gas, with the addition of 1750 gallons of oil per set per day at 5½d. per gallon delivered. The labour charges for one set remain the same as when working on blue gas; but for two sets they are increased to £10 6s. 4d. per day, since two operators per shift are then necessary.

The total cost of carburetted water gas of 465 B.Th.U. at Flathouse works-out at 3·62d. per therm for two plants, and 3·71d. per therm for one plant. (See columns 12 and 11 in table.) On a similar basis, the estimated cost of water gas of 400 B.Th.U., when working two sets, is 3·45d. per therm (see column 13).

### TOTAL CARBONIZING LABOUR.

It will here be of interest to give the total cost of carbonizing labour at both works during the past twelve months. These figures are as follows:

| Carbonizing Wages. | December Quarter, 1921. | March Quarter, 1922. | June Quarter, 1922. | September Quarter, 1922. |
|---|---|---|---|---|
| | d. | d. | d. | d. |
| Cost per 1000 c.ft. . | 3·49 | 3·11 | 2·94 | 2·69 |
| Cost per therm . . | 0·76 | 0·68 | 0·65 | 0·59 |

These figures, it will be observed, are much higher per therm than those used above; but it should be pointed out that they cover all the men employed on carbonization, including general foreman, boiler, exhauster, and power house attendants, tar, liquor, and water tower attendants, breeze trimmers, &c.

### RESIDUALS AND FUEL.

The figures given for residuals for the purpose of arriving at the net cost of coal are, in the case of the horizontal retorts, based on the average production over a very long period.

With regard to verticals, a gratifying feature in the working of the installation has been the excellent fuel results obtained. The figure for "Coke made for sale" allows for fuel used for steam raising, and also that lost by the generation of water gas in the retorts. The reduction in the amount of coke obtained is more than counterbalanced by the increased yield of gaseous therms and of tar and liquor.

It has not been possible to obtain accurate measurements of the tar and liquor obtained, owing to their being mixed with that from the horizontals; but the general increase in total production shows that the quantities used are on the low side. The figure given of 35 gallons of 10-oz. liquor per ton of coal is probably considerably lower than the actual.

The same remark applies to tar, and not only is the quantity increased, but the quality is improved, as can be seen from the comparative distillation curves of tar (after removal of water) obtained from our horizontal retorts on Durham coal, and from the new verticals when steaming Derbyshire coal (see above).

### WEAR AND TEAR.

As regards wear and tear, our experience on new verticals has been too short to give any reliable figures; and before an absolutely final determination can be arrived at, the installation will have to run several years longer. It is interesting to note, however, that in over fifteen months' working the only charge under this head has been the renewal of some of the cast-iron cheeks and centre plates supporting the bars of the step-grates. These were found to be cracked; but I understand from inquiries made that this is quite an unusual renewal, and I am prepared to admit that the fractures may have been due to shortage of water in the early stages, as we had trouble with the supply—due entirely to local difficulties. The retorts to-day are in excellent condition, and show no signs of erosion or damage due to steaming. The machinery shows few signs of wear, and there is every indication that the maintenance of the plant per ton of coal carbonized will be considerably less than with other carbonizing systems. Maintenance work on the telpher plant has been limited entirely to repainting a portion of the structure; and it may be worth noting that all portions of the trestle legs likely to come into contact with coke or clinker heaps have been encased in concrete.

### UTILIZATION OF WASTE HEAT.

Steaming of the charge in vertical retorts has come to stay; but steam must be obtained at a proper price, and suitably applied. This means the use of waste-heat boilers and superheaters. Engineers employing waste-heat boilers hesitate to give figures till they have had longer experience, and can state the full advantage attaching to their use. The advisability of such a boiler in connection with the new plant at Hilsea was carefully considered; and, in spite of the very low main-flue temperature (about 525° C.) which has consistently been maintained, and the low fuel consumption, it was calculated that the waste heat was sufficient to generate the whole of the steam necessary for steaming the charges, supplying the producers, and a possible margin for pumps and other plant in the vicinity, provided that a boiler efficiency of 70 p.ct. could be attained. Given a large heating surface, this should be possible, even allowing for the fact that the gases should not be cooled down below about 400° Fahr. in the boiler, in order to avoid the possibility of corrosion.

A further factor crept in, however—namely, the cost of the steam so produced. Steam at our Hilsea works is produced very cheaply from coke breeze in forced draught furnaces; and it was found that, after allowing for interest, depreciation, and maintenance charges, and for the cost of running the fan motor, the steam generated by a waste-heat boiler would be no cheaper than (if as cheap as) that at present being supplied to the plant. The question of the installation of the boiler was therefore held in abeyance until such time as the price is lower.

### CAPITAL CHARGES.

The question of capital cost is naturally one of great importance; and it is probable the present large capital outlay necessitated by some new carbonizing systems renders their adoption

prohibitive to many undertakings. The writer has found that most of the new systems involve a greater capital outlay than horizontals, and frequently this item appears to be out of all proportion to the advantages gained.

It has been considered that, if the capital cost of the new Hilsea installation of vertical retorts were given, the figure would be of little value, and, in fact, somewhat misleading, as the order was placed in 1918, when prices were at a high point. It is interesting, however, to note the difference in capital cost between vertical retorts and horizontals at the present time.

An estimate for a new modern horizontal retort-house of ten beds of ten's, each 23 ft. long, capacity 12,030 therms per day, and giving the results shown in column 7 Table II., would now be approximately £57,600, or £4800 per 1000 therms per day (£320 per ton of coal per day). This cost includes retorts and settings complete, in steel framework and brick-panelled house, together with all stoking machinery, coal and coke handling plant, and telpher extension. An installation of vertical retorts, similar to our new installation, including house, coal and coke handling plant, and telpher extension, and giving with steamed Derbyshire coal 1·788 million c.ft., or 8310 therms of 465 B.Th.U. gas, per day, would cost £52,300, or £6300 per 1000 therms per day (£505 per ton per diem). The difference is therefore £1500 per 1000 therms (or £185 per ton of coal carbonized) per diem in favour of horizontals.

The estimated cost given in Table II. shows that vertical gas (column 2) costs 0·15d. per therm less than horizontal gas from the proposed new modern horizontal retort-house (column 7). Making allowance for increased capital charges, however, the net saving in favour of verticals would therefore be reduced to approximately 0·07d. per therm, under present conditions, and with existing prices.

Similarly, a complete plant for the daily production of 980,000 c.ft. of carburetted water gas of 465 B.Th.U. would to-day cost about £8140, or £1780 per 1000 therms per day. The difference in interest charges between this plant and steamed verticals represents 0·24d. per therm, giving a net difference in the cost of the therm of 1·14d. in favour of verticals on Derbyshire coal with steaming. Corresponding figures for a blue water-gas plant are a cost of £6400, or £2300 per 1000 therms per day, giving a net difference of 0·25d. per therm in favour of steamed verticals. To make these comparative figures complete, it is necessary to adjust them for the differences in the cost of maintenance and wear and tear.

It may be interesting to the members to know that, in spite of additions and reconstructions of plant, the capital charge per 1000 c.ft. sold in my Company's accounts has actually decreased. The capital expenditure per 1000 c.ft. of gas and per therm sold is as follows:

| Year. | — | Cubic Feet Millions Sold. | Per 1000 C.Ft. | Therms. | Per Therm. |
|---|---|---|---|---|---|
| | £ | | s. d. | | d. |
| 1910-11 . | 472,839 | 1297 | 7 3½ | 6,874,000 | 16·5 |
| 1914-15 . | 503,853 | 1500 | 6 8½ | 7,500,000 | 16·1 |
| 1921-22 . | 626,837 | 1926 | 6 6 | 8,780,000 | 17·1 |

This table emphasizes the necessity for bringing all our gas-works accounts into line on the therm basis, as well as on the cubic foot basis; for though my Company's capital per 1000 c.ft. has decreased so satisfactorily in the last ten years, the actual capital expended per therm sold has slightly increased. But here it should be noted that at the present time we have a considerable surplus of plant, amounting, after allowing for repairs and stand-by plant, to at least 10 p.ct., whereas in 1914·15—*i.e.*, immediately before the erection of the Flathouse verticals—no surplus whatever existed for taking-up increased business. Presently, when this increased business is realized, the capital per therm will be reduced to 15·4d.

### General Conclusions.

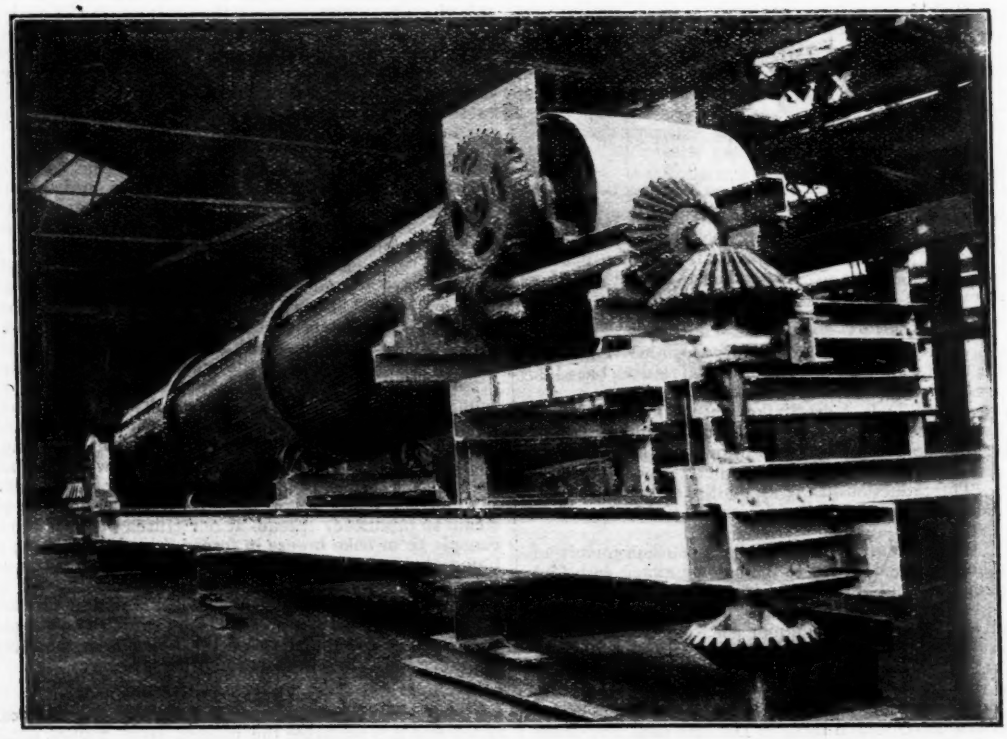
The importance of a right selection of carbonizing plant and its efficient working cannot be over-estimated, as on this depends almost entirely the cost of gas into the holder, and largely the price at which it can be supplied to the consumer. It may be at once said that, under the conditions obtaining in Portsmouth in 1918, our choice of verticals was thoroughly justified in every way; and it may be concluded that, when new plant must be installed, the erection of vertical retorts offers the best solution. But where existing horizontal plant can be cheaply reconstructed and modernized, the capital cost of vertical retorts may render them prohibitive for the purpose, in spite of improved results. This was found to be the case when we were considering the horizontal reconstructions now taking place at Hilsea.

But it must be borne in mind that the quality and character of the coal available for carbonization is without doubt a chief factor when considering this point. Unscreened Durham coal has been proved in our Flathouse installation to be unsuitable for the economical working of vertical retorts; and with this coal more efficient results and a cheaper therm can be obtained in horizontal retorts with heavy charges and efficient stoking and coke-handling machinery when interest on additional capital outlay is allowed for. In this connection, one bed of vertical retorts at Flathouse was working for a considerable period on screened Durham coal, the coal being screened by hand and separated for this individual bed. Though it was impossible to isolate or measure the gas produced, it was proved beyond doubt that the throughput could be materially increased; that a more even pull, resulting in lower inerts, could be maintained at the top of the retort, and that considerably less trouble was encountered through the hanging-up of the charge.

From this it may be presumed that, if screened Durham coal could be used throughout, labour costs might be reduced, and probably also wear and tear on the retorts. So obvious are these advantages that a screening plant is now being installed in connection with our main coal conveyors, so that the unscreened Durham coal received from the ship is to be immediately separated; the screened portion going on to the vertical retort-house stores and the screenings dropping down for use in the horizontal house.

### Gas Regulation Act, Inerts, &c.

Considerable controversy is taking place at the present time as to what is the best standard calorific power to adopt under the Gas Regulation Act. This, in the writer's opinion, is purely a



SCREENING PLANT FOR DURHAM COAL. (CAPACITY 100 TONS PER HOUR.)

TABLE III.—*Combined Actual Results—All Plants Working. (Twelve Months.)*

| — | | December Quarter, 1921. | March Quarter, 1922. | June Quarter, 1922. | September Quarter, 1922. |
|---|---|---|---|---|---|
| 1. Coal carbonized | tons | 31,974 | 29,502 | 26,054 | 24,832 |
| 2. Oil used | galls. | 194,484 | 203,647 | 117,123 | 159,766 |
| 3. C.W.G. made at 1·8 galls. per 1000 c.ft. | | 108,046,000 | 113,137,000 | 65,068,000 | 88,759,000 |
| 4. Coal and blue gas made | c.ft. | 448,676,000 | 424,406,000 | 404,148,000 | 402,656,000 |
| 5. Total gas made | ,, | 556,722,000 | 537,543,000 | 469,216,000 | 491,415,000 |
| 6. Total therms produced from Item 4 | | 2,046,859 | 1,936,466 | 1,842,155 | 1,838,527 |
| 7. Make per ton, including blue gas | c.ft. | 14,032 | 14,385 | 15,511 | 16,215 |
| 8. Therms per ton | | 64·01 | 66·38 | 70·70 | 74·03 |
| 9. Average calorific value—works tests (156 tests per quarter) | | 456·2 | 456·3 | 455·8 | 456·6 |
| 10. Tar made | galls. | 313,104 | 309,236 | 295,059 | 293,265 |
| 11. Tar made per ton of coal | ,, | 9·79 | 10·48 | 11·32 | 11·81 |
| 12. Liquor made (10 oz.) | ,, | 635,215 | 667,857 | 671,672 | 665,994 |
| 13. Liquor made per ton of coal (10 oz.) | ,, | 19·86 | 22·63 | 25·78 | 26·82 |
| 14. Coke available for sale per ton of coal (including coke used in water-gas plants) | cwt. | 9·78 | 10·73 | 9·93 | 10·42 |
| 15. Coke available for sale per ton of coal (including coke used in C.W.G. only) | ,, | 8·55 | 9·65 | 8·59 | 8·95 |

question to be decided by local conditions, of which the local coke market is by no means the least.

The Portsea Island Gas Light Company received an Order under the Gas Regulation Act early in 1921, and the standard calorific power was fixed at 450 B.Th.U. gross. This has proved to be a satisfactory quality in our case, and was the figure which, after eighteen months' experience in the production and distribution of the lower quality, permitted of the most economical production of therms with the available producing plant. I have already referred in Table III. to the results of our average working at both works for the twelve months ended September last, during the whole of which time we were working under the Gas Regulation Act. Since it is economically necessary for us to manufacture water gas, a consideration of the table of gas costs will show that it is desirable to use as little oil as possible for enriching purposes; and accordingly we have no desire under present conditions to raise our standard of calorific power. This opinion is confirmed by the fact that we find no difficulty in distributing the requisite number of therms at this calorific value through the existing mains and services.

The control of the gas quality receives very careful consideration, and is effected by means of recording calorimeters, $CO_2$ recorders, and gravitometers at each works. The recording calorimeters are checked several times daily by tests on the Boys instrument; and in order to ensure it is of 450 B.Th.U. at any part of the district, a quality of 460 B.Th.U. is aimed at for the gas leaving the works. It may be interesting to the members to know that the average of our tests on town gas for the past twelve months was 456·2 B.Th.U., while the Gas Examiner's tests for the same period averaged 455·1 B.Th.U. (see Table III.).

The question of inerts has not been of serious moment; and with vertical retorts and suitable coal, no trouble is anticipated. Whatever may be the arguments as to high inerts not being prejudicial to general efficiency in the use of gas, they can in no way improve it, and every endeavour is therefore made to maintain as low a percentage as possible. The hanging-up of the charge when carbonizing Durham coal actually tends to an increase of nitrogen. It will be seen that the nitrogen in gas obtained from the vertical retorts' guarantee test averaged 10·5 p.ct.; but for reasons explained above a larger excess of air was of necessity admitted on this occasion, and the actual working average is probably nearer 8 p.ct.

In conclusion, a word may be added as to the sale of gas on the thermal basis. Apart from the universal difficulty of explaining the therm to consumers, we have experienced no trouble or loss of goodwill through the change to the therm basis, or through supplying gas of a lower calorific value; but it should be added that the maintenance of an adequate pressure at every point in the district receives our constant and careful attention. The minimum pressure is slightly over 2 in. in the outlying portions of the district at the period of peak load—Sunday cooking time. As with most other undertakings, this period severely taxes our distributory system, for in the three hours from 11 a.m. to 2 p.m. on Sunday we regularly send out 2½ million c.ft.—over one-third of the day's make—and from 12 noon to 1 p.m. the issue approximates to 1 million c.ft.

Tests have been carried out in the Company's laboratories on the utilization of lower qualities of gas in cookers and gas-fires, inverted burners, &c.; and efficiency tests have also been taken with various grades. Space does not permit of results being given, nor is the subject strictly covered by the title of the present paper. It is sufficient to state that the results of these tests, together with the considerations mentioned above, amply justify our choice of a 450 B.Th.U. standard.

The writer desires to express his thanks to the members of his staff, and especially to his Chief Assistant, Mr. S. E. Whitehead, B.Sc. Eng., for assistance given in carrying out tests and experiments which have formed the framework of this paper.

## DISCUSSION.

The PRESIDENT (Mr. J. M. Campbell, of Margate) said he was glad the members had, by their applause, shown full appreciation of the excellent paper which they had just had from Mr. Carmichael. It was one that must have called for an immense amount of time and labour, and was comprehensive and thorough in its treatment of the various matters with which it dealt. The paper was now open for discussion; and as they were favoured with the presence of Sir Arthur Duckham (one of their honorary members), and as the subject was largely connected with vertical retorts, he thought he might ask him if he would speak first.

Sir ARTHUR DUCKHAM said he was very pleased to be with them as one of their honorary members. It was a privilege he very much appreciated. He was also glad to have had the opportunity of listening to Mr. Carmichael's paper. They must all of them, he felt sure, agree that it was one of the best papers they had ever had on carbonization. ["Hear, hear."] He had succeeded in putting his facts and figures forward in a manner that would be of great use to all those who took an interest in the important question of efficiency of carbonization.

### TESTING CONDITIONS.

There was one point which was of importance to them all as engineers, and that was Mr. Carmichael's testing conditions. If he (Sir Arthur) might speak for a moment from the point of view of the contractor, he might say that when his people saw Mr. Carmichael's testing conditions, and came to know Mr. Carmichael, they felt they were up

## APPENDIX.

### PORTSEA ISLAND GAS LIGHT COMPANY.

WOODALL-DUCKHAM VERTICAL RETORTS AT HILSEA WORKS.

**Tabular Statement of Guarantees when Carbonizing different Coals.**

NOTE.—The following figures are given on fair average samples of gas coal, having an ash content not exceeding 6 p.ct., and are calculated upon what is recognized as the "dry basis," and are allowing for all the retorts to be at work. The plant consists of one bench of seven settings, each containing four retorts and one producer.

| — | Derbyshire. | Yorkshire. | Durham. | Mixed 60 p.ct. Midland and Durham 40 p.ct. |
|---|---|---|---|---|
| Capacity of plant on straight gas | 1,587,600 c.ft. | 1,638,000 c.ft. | 1,310,400 c.ft. | 1,339,000 c.ft. |
| Capacity of plant on steamed gas | 1,587,600 c.ft. | 1,474,000 c.ft. | 1,361,000 c.ft. | 1,474,000 c.ft. |
| Coal capacity of one retort on straight gas | 5½ tons | 5 tons | 4 tons | 4½ tons |
| Coal capacity of one retort on steamed gas | 3½ tons | 3½ tons | 3 tons | 3½ tons |
| Make on straight gas per ton at N.T.P. 510 B.Th.U. | 12,000 c.ft. | 13,000 c.ft. | 13,000 c.ft. | 12,500 c.ft. |
| Make on steamed gas per ton at N.T.P. 460 B.Th.U. | 18,000 c.ft. | 18,000 c.ft. | 18,000 c.ft. | 18,000 c.ft. |
| Yield of therms per ton of coal at N.T.P. 460 B.Th.U. | 82·8 | 82·8 | 82·8 | 82·8 |
| Tar in gallons per ton on straight gas | 12 | 12 | 10 | 11 |
| Tar in gallons per ton on steamed gas | 15 | 15 | 13 | 14 |
| Fuel consumption per ton on straight coal gas | 2·15 cwt. | 2·25 cwt. | 2·8 cwt. | 2·65 cwt. |
| Fuel consumption per ton on steamed gas | 3·22 cwt. | 3·46 cwt. | 3·73 cwt. | 3·46 cwt. |
| Men required per 24 hours (from coal wagon to coke hopper) | 23 | 23 | 23 | 23 |

against something severe. To run a 28-day test on a plant, day and night, with the watchful eyes of Mr. Carmichael and his staff upon everything, and under fairly high guarantees, seemed to them a difficult matter; but he would like to tell the members that those men, who were at first frightened of this test, afterwards came to him and said they wished all engineers would adopt the system of a 28-day test, instead of the standard 72-hour test. They declared that a 28-day test was a proper test of a plant. The workmen had time to get used to the plant, and so could continue to obtain the same figures after the contractors had left. One thing that had struck him in connection with the paper was the comparatively very low combustion chamber temperature during this period—1216° C. This he presumed was a good deal lower than that of the horizontals working at the same time, and it was considerably lower than vertical retort practice in general. He had lately seen various vertical retorts in the North of England, and they were being worked at 1350° or 1300° C. Mr. Carmichael's figure was therefore a remarkably low one with which to have obtained these results. With a higher temperature he would have got a greater throughput.

### Importance of a Fixed Quality of Coal.

On another subject he (Sir Arthur) could speak as somebody who had had a certain amount of experience, and that was the question of coal. Undoubtedly, this was a matter of great importance in connection with continuous vertical retorts; but provided they had a fixed quality of coal from day to day, he had seen vertical installations working satisfactorily with any class of coal. At the present time there were many plants of all kinds operating satisfactorily with Durham coals; and repeat orders had been given for installations working with these coals. Provided one secured constant conditions, Durham coals would give satisfaction. They needed more "cooking," of course, and therefore there would be a lower throughput. At a Midland works with a very large experience of vertical retorts, they were getting a throughput of 5·16 tons of Midland coal per day with their verticals. They worked for a period of six months on Durham coal, and the throughput on the same plant was 4·8 tons per day. Then they were forced to work intermittently with Durham and Midland coals, and their throughput was 3·5 tons per day. This, he thought, was the whole secret of the question of coals in verticals. Mr. Carmichael had at Flathouse an older plant than at Hilsea, and undoubtedly he would get better results with Durham coal at the latter than at the former works. To get the best results, it was necessary to work with one class of coal, or as near as they could get to one class. As to waste-heat boilers, he did hope that engineers would give this matter their careful consideration, for it was well worth their while to do so. The latest practice was to replace the electric motor for the fan with a high-speed steam-engine driven from a waste-heat boiler. Mr. Carmichael said he had had no trouble with therms. Would he have expected any trouble if he had been supplying 520 B.Th.U. gas, instead of 460 B.Th.U.?

### Coke and other Figures.

Mr. P. S. Hoyte (Plymouth) said there was one omission from Mr. Carmichael's very elaborate and valuable tables of costs—particularly with regard to labour. He had not included the labour to which he had been put in preparing the paper; but this, of course, was not a continuing charge, like the other labour referred to. There was one criticism he had to make which would apply in the case of almost all the works on the South Coast. Reference was made in the paper to the poor coke market; and he did not think in these circumstances, when working (as Portsea Island, Plymouth, and a number of other undertakings similarly situated, had to do) with a rather large percentage of carburetted water gas, that it was quite fair to debit the carburetted water-gas plant with coke at the selling price in the district. It was a two-edged sword. They not only increased the cost of the water gas by charging an excessive price for the coke, but they unduly benefited the coal gas by crediting it with this excessive price. If they had all coal-gas plant on the South Coast, they would not know what to do with their coke. Say Mr. Carmichael was making 25 p.ct. of water gas, if he were to replace this with coal gas, he would have at least 20,000 tons extra of coke on the local market; and with this added to the coke he was now finding a market for, it would certainly be impossible to maintain the price of 27s. 6d. per ton. He thought this went to the root of a good many of these calculations. It was very interesting to see that it had become necessary, at any rate at the Portsea Island works, to screen Durham coal. This brought another factor into consideration. If they were going to send the screenings down to the horizontal plant, in order that they might give the cream of the coal to the vertical plant, this was bound to depreciate the horizontal retorts; and he did think that the verticals should be debited with this depreciation. With regard to the calorific power of the blue water gas, the author stated this was 303 B.Th.U. Such a figure meant a very small percentage of inerts, and he was to be congratulated upon it. To determine the relative costs of coal and water gas was very difficult; and he had always found it better to lump the two together. One got to a point where one could sell no more coke, and this meant that it was impossible to manufacture more than a certain percentage of coal gas. That was a point which had to be borne in mind.

Mr. J. W. Whimster (Bath) remarked that, in connection with the author's comparisons between vertical and horizontal retorts, there were one or two criticisms which, speaking as one who had not yet been converted to the benefits of verticals over horizontals, he would like to offer. In the first place Mr. Carmichael had to use a better class of coal, costing 32s. per ton for his verticals, as against coal costing 27s. 10½d. per ton for horizontals. In comparing the residuals for sale, the author said, when steaming verticals, there was 9 cwt. of coke per ton for sale, and dealing with the coke from the horizontals he still said 9 cwt. for sale. This was too low for horizontals. The horizontals at Flathouse they knew were not up-to-date, but 10 cwt. would not be a high figure by any means. Also for horizontals he gave a figure of only 21 gallons of liquor per ton, which, again, was too low. From Durham coal, 28 gallons should easily be obtained. The net cost of coal per therm for the vertical retorts was given at 2d., and for horizontals at Flathouse 1·97d.; but if credit was taken for what he had just pointed out, it reduced the figure for horizontals to 1·69d. per therm. This was for the settings at Flathouse; but if they considered putting-up a new house, as was suggested, of modern horizontal retorts (which, after all, was what should be compared with a new vertical house), in that case they should get 10½ cwt. of coke for sale. This would further reduce the figure for horizontal working to 1·58d. per therm, as against the figure of 1·97d. given for Flathouse.

The President: You mean exclusive of breeze?

Mr. Carmichael: How much breeze?

Mr. Whimster said the figure given in the paper—1½ cwt. In dealing with the cost of labour, comparison was made of up-to-date verticals with old-fashioned horizontals. In the vertical installation the coal was tipped by a wagon tipper and conveyed to overhead storage hoppers having a 48 hours capacity. In the horizontal house he presumed the coal was unloaded by hand and probably wheeled to the elevators, as the number of men given was 8, as against 2 for the verticals; and as the vertical installation dealt with practically twice the quantity of coal, this would mean about 16 men on the same basis. He did not think this was a fair comparison. The coal and coke handling installations of the two systems should be taken on the same basis, if a fair comparison was to be made. The figure for labour in the case of the horizontals at Flathouse was given at 0·47d. per therm, and he saw from the author's estimate that at Hilsea, when the twenty beds were reconstructed, this would be reduced to 0·23d. He thought with a modern installation of horizontal retorts, fitted with coal and coke handling plant similar to verticals, the cost for labour should only be about 0·17d. per therm. Adding to this the net cost of coal (1·58d. per therm) the total cost for modern horizontals would be 1·75d. per therm as compared with 2·44d. for the Flathouse installation and 2·22d. for verticals. This really showed a saving of almost a halfpenny per therm for horizontals over verticals when comparing modern horizontals with a modern vertical installation. Added to this must be the saving in capital expenditure. Repairs, he thought most engineers admitted, were higher in verticals than in horizontal installations, though he believed the author rather claimed they would be a little bit less.

### Suitable Coal for Continuous Verticals.

Mr. G. M. Gill (London) said he did not know how many of the members had seen Mr. Carmichael's works. He had had this pleasure, and had seen his new installation of vertical retorts at work. He thought it was a magnificent installation, and was working particularly sweetly. One could not see any flaw at all. It all looked very efficient. He had been particularly interested to hear Mr. Carmichael's views with regard to suitable coal for use in continuous vertical retorts. He was interested because Mr. Carmichael confirmed, and had confirmed in his paper, what a good many had hinted at—that to get really good results out of continuous verticals, one needed suitable coal. Mr. Carmichael also demonstrated to his (the speaker's) satisfaction that if they took the fine out of Durham coal, then they had a really suitable coal for verticals; and this was something which he hoped one day the colliery proprietors would do—that was to say, that they would prepare their coal for the gas manufacturer's use. If they took out the fine coal, they could wash it, and it would be very suitable for coke-oven use. Coke-ovens required fine coal; and in this way the nuts would go to the gas-works, and the fine to the ovens. He agreed with Mr. Whimster in regard to some of his figures. Mr. Carmichael estimated that in his new horizontal retort-house he would make gas at a certain figure which was not altogether favourable when compared with his verticals; but he (the speaker), like Mr. Whimster, thought that when he got to work with these horizontals he would do a good deal better than he had counted upon. As Mr. Whimster pointed out, 9 cwt. of coke made for sale from Durham coal in new horizontal retorts was not good enough; and he had no doubt that Mr. Carmichael, if he managed the new horizontal house like he did his verticals, would get 10½ cwt., or perhaps even 11 cwt., of coke. This would make a tremendous difference in the figures. It brought them down a good bit below the verticals. Then, again, as Mr. Whimster had said, the ammonia was also a good deal too low. Instead of 21 gallons of 10 oz. liquor, he would probably get nearly 30 gallons. Mr. Carmichael also stated that he was going to use large retorts in his horizontal house, with 18½ cwt. charges. He (Mr. Gill) ventured to suggest that one could get better results from horizontals with smaller retorts and smaller charges. It was a question of getting the heat through to the centre of the charge. With these very big retorts, the central portion of the charge took an amount of time to heat quite out of proportion to what it was worth. He considered Mr. Carmichael's paper one of the most useful and interesting that had ever been submitted to the Association.

Dr. R. Lessing (London) said that his excuse for joining, from a chemical point of view, in the discussion on this gas engineering paper was that the question of coal quality had been raised by practically every speaker so far. He certainly thought the collieries should see to it that users only got clean coal suitable for any particular purpose. Only a few days previously he had taken the opportunity of urging mining engineers that they should see to it that clean and pure coal was delivered from the various collieries. The question of suitability of coal was not one entirely of size. That had been brought out during the last few years, since they had approached the problem in a proper spirit, that the fines could not be regarded as of the same average composition as the whole coal. In fact, they knew that coal was a mixture of a great number of different ingredients of vitally different composition both organically and minerally. If the coal got broken up partly to make fines, these fines would have a different chemical composition. It was largely for this reason, and not only because of its different size, that this portion of the coal was unsuitable for vertical-retort working. This was a point that ought to be insisted upon. Chemists should study more the composition of various coals. It was a matter of finding out the composition and the behaviour of the different sizes of coal in the carbonizing process.

Mr. A. E. Broadberry (Tottenham), being called upon by the President, said he thought the experiences of the present live gas engineers would be more valuable to a meeting of this sort than the antiquated ideas of a director. [Laughter.] However, there was one point he would like to emphasize, and that was the danger of building too much upon the comparative figures that Mr. Carmichael had

given. There were other things besides cost of labour and coal which very materially affected the question. Particularly, as Mr. Whimster had said, there was the question of repairs and maintenance; and when they came to add all these other costs, it might alter the aspect of the comparisons very considerably indeed, not only in regard to horizontal and vertical working in coal-gas manufacture, but also in regard to carburetted water-gas manufacture. Mr. Carmichael warned them that it was advisable to use as little oil as possible; but when they came to add on the additional costs, besides materials and labour, to which he had referred, they might come to a different conclusion. He thought it would be found that they got back practically all the value of the expenditure on oil with the extra service obtained in the manufacture of carburetted water gas.

Mr. THOMAS GLOVER (Norwich), who was also called upon, expressed his admiration of the quality of the paper and the amount of work put into it. It would be very useful to those who had to decide how best to increase their carbonizing capacity. One or two points had arisen out of the discussion which were exceedingly interesting—particularly with regard to the grading of coal. It was now, he thought, accepted that very small coal retarded the speed of carbonization seriously; and those who had to use Durham coals, either in horizontal or vertical retorts, must allow for higher temperatures if they were to penetrate the charge and get it burned-off in a reasonable time, or in the case of verticals obtain a reasonable throughput. He agreed with Mr. Gill that for this reason the very small coal ought to be left behind at the colliery, suitably cleansed, and used in coke-ovens. Once the coal was screened and graded at the colliery, it would not be unscreened again by the time it got to the gas-works. Dr. Lessing had made it quite clear that once the small had been made and had been removed, there were not the same elements present in the graded coal to make smalls again. This was due to the varying composition of coal. They had all been thinking of a piece of coal as homogeneous and composed of the same elements; but it was not so. A seam of coal analyzed by making microscopical sections revealed very great differences, and the parts that made dust were quite different from the others. He was a great believer in graded coal, either for horizontal or vertical working. Sir Arthur Duckham, he thought, had raised a protest against the wholesale condemnation of the use of Durham coal in verticals. Certainly it would not do for those present to go away from the meeting with the impression that Durham coal could not be used in vertical retorts. It was being used entirely in large installations of verticals every day of the year, and with very good results and no particular drawbacks; but it was a question of knowing what one was using. If the conditions were arranged for that class of coal, it could be used quite well. The impression must not be taken away that unscreened Durham coals were not suitable for verticals; but if these unscreened coals were graded, the throughput would be considerably increased, and he had no doubt ease of working would follow too.

### A DECISION AT READING.

Mr. D. H. HELPS (Reading) remarked that Mr. Whimster and Mr. Gill had alluded to the difference in the amount of coke for sale with vertical and horizontal retorts. There was one reason for this which had not been mentioned—namely, that when one sold coke from verticals one was selling coke; but when one was selling coke from horizontals, one was selling coke and a very large amount of water. It was necessary to extend the plant at Reading some years ago, and he had to advise his Directors on the matter. He found it extraordinarily difficult to know what advice to give. When he went to Reading there was an excellent retort-house, and they were getting as good results as most people with horizontals; but he eventually decided to advise verticals. Though he had only had two months' experience, he felt fairly well convinced that his advice was sound. With horizontals it was appalling to see the enormous waste of gas, which did not occur with verticals. He was sure in his own case that the verticals would give at least 50 p.ct. saving in labour, and perhaps more; and the work was far less arduous. One thing he did not care about was that it was impossible to enter a vertical house and form an opinion at a glance as to how things were going on, to the same extent that could be done with a horizontal house. There was nothing to be seen. [Laughter.] If he were to consider the matter from a purely personal point of view, he would continue to use horizontals; but considering it from his Company's point of view, he was bound to go in for verticals.

Mr. ARTHUR VALON (London) said that some doubt had been thrown upon the estimate of coke available for sale from horizontal retorts. After all, Mr. Carmichael estimated 9 cwt. of coke and 1½ cwt. of breeze—together over 10 cwt.; and in looking at a good many results recently, his experience had been that there were very few places where this amount was exceeded. Therefore Mr. Carmichael's estimate was a very fair one. He was to be congratulated upon the extremely clear manner in which he had put forward his results. The paper would be valuable to all for reference; and it should also be of assistance to those who were going to publish their results. If they would take Mr. Carmichael's contribution as an example, and follow it, everyone would get a great deal of information in a very accessible form.

The PRESIDENT said he had Woodall-Duckham vertical retorts, but unfortunately only five beds of four. He must use one man at the top, one at the bottom, and one for fires; and hence the cost of gas per 1000 c.ft. and per therm came out at a little more than Mr. Carmichael's, for he had the same number of men for seven beds of four. The figures in the paper would, as had been remarked, be useful for reference. It was very difficult in the course of an afternoon to deal with a paper so extensive and comprehensive. The question of coke and breeze, &c., had been dealt with very fully. As to his own experience with Durham unscreened coal, all he had to say was that, once he got it fairly going, he was able to work for quite long periods without undue difficulty. There was more trouble in getting it to pass through the retort than with other coals; but provided they got the same run of coal for such a length of time that the men became accustomed to it, they worked it quite satisfactorily. As to wear and tear, their experience with verticals in operation since 1914 was that they cost less, even with war prices, than the repair and maintenance of inclined retorts in pre-war days. He was putting-in a waste-heat boiler, and would be able, by utilizing the heat coming from the retorts, to generate sufficient steam at 120 lbs. to supply all the verticals, and also to drive a high-speed engine for the fan. All this would be obtained without labour and without fuel, and also it would avoid the necessity of putting in another boiler. He proposed a hearty vote of thanks to the author of the paper; and this was passed by acclamation.

### THE AUTHOR'S REPLY.

Mr. CARMICHAEL, on rising to reply to the various speakers, expressed his appreciation of the manner in which his paper had been received. The discussion had been most gratifying. Sir Arthur Duckham he thanked extremely for his complimentary remarks. He had expected him to be a little more critical. With reference to the 28-day test, he (the speaker) had had too much experience in the past of 24 or 72 hour tests. He was glad to hear that the 28-day test had commended itself to Sir Arthur, and that he was wishful for other engineers to make the same condition. The combustion chamber temperature was certainly low; but he was afraid that he must take the blame for this. As a matter of fact, it being a new plant, he did not want the contractors' men to "play ducks and drakes" with the brickwork. They were working at a higher temperature to-day, and perhaps this was the reason why the results of the guarantee test were being at times exceeded. The retorts were all Glenboig, with silica back walls. So long as Durham coal was used for gas-making purposes, he was afraid the horizontal retort would always be the more serviceable one. He agreed that one class of coal should be carbonized in continuous vertical retorts. At Hilsea they were carbonizing Derbyshire coals—three coals practically from one seam, and with the same characteristics, but from different pits. He was very pleased to hear that Sir Arthur had given-over the electric motor, because it was an expensive drive; and he felt certain they would now be able to justify their expenditure on a waste-heat boiler. He had been asked whether everything would be as satisfactory if they were supplying a 520 B.Th.U. gas. They were supplying gas of this calorific power before the war, with very satisfactory results; and to-day they were doing equally well with 460 B.Th.U. gas. Mr. Hoyte referred to the coke market, and with what had been said by him he quite agreed. If gas companies situated on the South Coast, like Brighton, Hastings, Portsmouth, Southampton, Plymouth, and Bournemouth, all stopped water-gas manufacture to-morrow, he did not know what the price of coke would fall to. Referring to the price of 27s. 6d. per ton in the paper, he might say that at Flathouse, if they reduced the price of coke 1s. 11d. per ton to-day, the price of blue water gas would be 2·6d. per therm, and so would the coal gas. As the price of coke was reduced, so was the cost of the water-gas therm reduced, but the price of the coal-gas therm went up. To-day 1s. 11d. was the difference. At Hilsea a drop of 3s. 4d. would balance the two costs, and make the figure 2·48d. per therm. They were working at the economic limit, and manufactured water gas because it paid them to do so. Mr. Hoyte had referred to the cream of the coal going to the vertical house; but he did not think this was quite correct. With Durham coal, they had had several tests of screenings and also of rough coal, and he found the percentage difference in moisture and ash contents in the two qualities was practically nothing—at any rate, it was negligible. The screenings did not affect the quality of the coke at all—the same quality of coke being produced in the horizontal retorts. He would take Mr. Hoyte's appreciation of the 303 B.Th.U. per c.ft. for blue water gas, for this was the actual test figure. [Laughter.] Mr. Whimster was not quite correct in his figures. He said that 9 cwt. of coke for sale was too low for horizontals to-day. A subsequent speaker had referred to moisture. His (Mr. Carmichael's) figures were all reduced to a common moisture basis of 7 p.ct. During the 28-day test, they had 7·1 p.ct. of moisture. To put the horizontal house results on a comparative basis, he took the dry coke and then corrected it to 7·1 p.ct. moisture. He did not know what the moisture percentage was at Bath, and was afraid to ask Mr. Whimster. [Laughter.] Mr. Whimster had overlooked the fact that the results for the proposed new up-to-date horizontal retorts came into the Hilsea column. They received Durham coal at Flathouse, and had to transport it to Hilsea—costing from 1s. 6d. to 2s. per ton, and therefore the costs given allowed a little for extra coke from the proposed new installations. The ammonia return he agreed was on the low side, but it was what they were doing now. It was hoped to improve it at a later date. He thanked Mr. Gill for what he had said with regard to the Hilsea works. Mr. Gill had had considerable experience with the use of small retorts, and what he had to say regarding them must be taken into consideration. He agreed with Dr. Lessing as to approaching the collieries with a view to the delivery of better coal. He himself would welcome—and he was sure the other members would—an effort in this direction. The composition of coal did vary tremendously. As to Mr. Broadberry's remarks, of course capital charges were a very important item. He had pointed out in the paper that in this respect verticals cost more than horizontals. With regard to repairs and maintenance, a vertical plant working on Durham coal cost more than horizontals; but on Derbyshire coal they hoped it would be the reverse. He thought they would save on repairs. He agreed with Mr. Glover's remarks as to throughput. With Derbyshire coal they could get a throughput of 5¼ tons, and with Durham 4 tons. Durham coal could be used with fairly good results; but he did not think the best results could be got in verticals with Durham coal. From Durham coal the cheapest therm was produced in the horizontal retort. The vertical retort was ideal in theory; but he was of the opinion that horizontals would always be the more serviceable with Durham coal. If he wanted additional steam to-day, he should certainly put in a waste-heat boiler, after hearing what Sir Arthur Duckham had said. But to instal a waste-heat boiler and then shut-off a Lancashire boiler would be false economy. Mr. Carmichael concluded by congratulating the President on his excellent results.

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**South Metropolitan Gas Again Reduced.**—The South Metropolitan Gas Company have decided to reduce the price of gas from 10d. to 9d. per therm, as from the date of reading meters at Christmas.

# NORTH OF ENGLAND GAS MANAGERS' ASSOCIATION.

**Auxiliary Meeting.**

THE Seventh Half-Yearly Auxiliary Meeting in connection with the North of England Gas Managers' Association was held on Saturday last in the offices of the Newcastle and Gateshead Gas Company, Grainger Street West, Newcastle-on-Tyne—Mr. W. E. OULDS, of Tynemouth, presiding.

On the motion of Mr. F. COOK, seconded by Mr. H. L. SMITH, Mr. W. L. Robertshaw, of Sunderland, was elected Chairman of the auxiliary section for the ensuing year.

Mr. W. W. WELLS moved, and it was agreed, that Mr. C. J. Barrett, of West Hartlepool, and Mr. Herbert Lees, jun., of Hexham, be elected members of the Committee.

Mr. A. BELL (of Morpeth) then read a paper on "The Making of Gas and Water Connections Under Pressure and the Uses of Some Modern Tools and Appliances," which, together with the brief discussion, will be published in an early issue.

Mr. E. F. CRAGGS (Newcastle-on-Tyne) followed with a paper on

## GAS-FIRED BAKING OVENS.

The subject of this paper, although of considerable and increasing importance, is one upon which very little detail has hitherto been published, and about which experience and first-hand information is very difficult to collect. It is a subject which calls for special consideration at the present time when bakers' working costs must be reduced to the lowest possible figure, regardless of inconveniences. The baker, like all other tradesmen, is suffering from lack of business, and, in the matter of fuel, cost is his prime consideration. Comfort and ease of manipulation, which were two of the main factors in recommending gas, can be endangered and sacrificed for dirtier and more inconvenient fuel solely on the score of cost. The baker, especially if he is working his own ovens, prefers gas; but at the present time working costs are of such vital importance that he may decide in favour of coke, on account of the present price of gas. Substantial reductions in the price of gas have been made; but it cannot be stated when and by how much prices of gas will be further reduced. Therefore, it is essential that all possible steps should be taken in the meantime to provide the greatest efficiency in the working of gas-fired ovens.

The first thing to do is to study the baker's requirements, and provide him with an oven which will meet all his varying wants. In the design, every effort must be directed towards economic efficiency and, if possible, prevention of waste by careless handling. An essential feature of a baker's oven is that it must be capable of imparting solid and flash heat either separately or simultaneously as required. The terms "solid" and "flash" heats are bakers' terms, with practically the same meaning as "radiant" and "convected" heat. The solid heat implies a continuous or radiant heat; the flash is a temporary intense or convected heat.

### BREAD BAKING.—THE BAKER'S REQUIREMENTS.

In the oven the dough rapidly swells from the expansion of the gases within the loaf. The outside is converted into a crust; the starch being changed into gum and sugar. These are at a high temperature, and so give the crust its characteristic colour. The effect of the heat in the interior is to evaporate a portion of the water present in the dough; and in considering the temperature it should be specially noted that while any water is present in the bread the temperature of its interior can never rise much above the boiling point—say, 215° Fahr.—for when the loaf is thoroughly baked it still contains about 35 to 40 p.ct. of moisture.

*Solid Heat.*—From this it will be seen that for bread baking the oven must embody a sufficiency of material in its construction so that when it is heated throughout it will radiate heat into the working space slowly, steadily, and continuously. Insufficient material means that the oven cools-off too quickly, and, consequently, must be heated very intensely at the commencement, with the result that it at first burns the bread, and towards the end has not heat enough to complete the baking of the batch. With thicker material the initial temperature need not be so high; the fall in temperature takes place more slowly, and the oven still retains a good heat at the close of the baking. Sufficient thickness is required that these conditions may result in the interior of the bread being well baked, while the crust is not burned.

*Flash Heat.*—A flash heat is produced by introducing highly-heated gases into the oven. Such introduction of flame should be employed primarily to raise the temperature of the body of the oven, not, if used at all, to bake the bread itself. The reason is obvious. It is exceedingly difficult to regulate with exactitude the temperature of a current of hot air from a flame. The temperature is sufficiently high at one time to burn the crust; at another, so low as to prevent the inside being properly cooked during the time allowed for baking. The flash heat is extremely useful to the baker in special circumstances, such as in baking small fancy cakes, as if the heat can be properly controlled and directed downwards upon the cakes it will give that colour and finish so much desired.

A summary of the baker's requirements in an oven may thus be taken as follows:

Construction to be of good, solid material, so as to get a steady uniform heat.

Operation to be continuous (no time to be wasted in re-heating the oven between batches).

Flash heat to be under perfect control, and capable of being directed downwards.

Controls for rapidly heating-up or cooling-off to be provided.

Handling and changing of position of loaves after oven is loaded should be unnecessary.

The various kinds of ovens in general use may be classed as: (1) Internally, (2) in part internally, and (3) externally heated.

### SOLID FUEL OVENS.

*Internally Heated Ovens.*—The internally heated oven does not meet with much favour. If it is coke fired, the furnace is built in a corner of the oven, and the flue taken off from the opposite side. A full draught is allowed until the brickwork attains the required heat, then the flue is closed and baking operations start. This heating and baking goes on alternately when bread is being baked. With smalls, baking can go on continuously; but a great deal of time is lost. Other objections to this type are its absolute dependence upon skill in working and the absence of hygiene.

Gas has been introduced into this type of oven with great success as against the solid fuel.

### HOT AIR OVENS.

*In Part Internal.*—In this case the flues are so placed as to heat up the tiles and walls as far as possible, and sometimes allowed to enter the baking chamber, and the heat regulated with dampers. These ovens bake well; but the numerous flues invariably give trouble, and the fuel consumption is heavy.

*Electric Ovens.*—These may be dismissed as too expensive in working. The current required is somewhat about 80 kilowatts per sack baked.

*Steam-Pipe Ovens.*—These are probably the most favoured oven of the solid-fuel type. They are designed on scientifically correct principles. The oven maintains a steady maximum heat, and requires very little attention and skill in working; but the lower temperatures are difficult to maintain.

*Small Portable Coke Fired Ovens.*—These are two-decker ovens, and familiar to everyone as an externally heated oven with tiled sole. The temperature of the top-deck is usually about 100° Fahr. less than the bottom oven.

All the foregoing solid fuel ovens fulfil the requirements of the baker very well, owing to their mass of brick work and solid and steady flow of heat to the goods being baked; but all the benefits of the solid-fuel ovens can be obtained in a gas-fired oven, with several additional advantages. For instance, a part-internally heated gas-oven would maintain to a degree a moist atmosphere which greatly improves the appearance of bread compared with the dry heat of externally coke-fired or steam-pipe ovens. The ease and rapidity of cooling-down or heating-up of the oven by gas is a tremendous advantage. The internal or external heat could be supplemented at will without the use of high chimneys, draughts, or dampers, apart from the advantages of hygiene, &c.

### GAS-FIRED OVENS.

#### No. 1.

*Household and Shelf Oven.*—Gas-fired ovens on the principle of the household oven do not in any way meet the requirements of the professional baker. The variation in temperature and the absence of uniform heat condemns the principle of allowing the flame to enter directly into the baking chamber. There is no thickness of refractory material, so that the oven is solely dependent upon the flame temperature. This applies in a varying degree to all types of internally heated shelf ovens. In a four-shelf oven the heat is excessive on the under side of the bottom shelf; a considerable drop in temperature occurs on the two centre shelves; and an excessive heat is created in the crown, and burns the articles on the top shelf.

#### No. 2.

*Internally Heated Brick Ovens.*—These ovens are built with the required thickness of brick work, and very good results are obtained. They are internally heated by allowing the flame to enter directly into the oven, until the required temperature has been obtained, when the gas is shut off and baking operations commence. Unfortunately with this type baking is not continuous; the operations of heating-up and baking being carried on alternately. It is also necessary to raise the initial temperature much above what is required in order to allow for the loss of heat during the baking period and ensure sufficient heat to complete the batch, as the gas cannot be lighted again when the oven is loaded.

#### No. 3.

*Part Internally Heated Ovens.*—This type of oven is designed to provide the required thickness of material for solid-heat baking, and a separate burner to provide a downward flash heat of any temperature desired. The heat is applied externally to the fire-brick sole, and the waste heat, after heating the sole, is made to pass through the baking chamber before entering the flue. The double travel of the gases ensures a great economy in working, as the waste heat is sufficient to give the desired colour and finish to

the article. The separate burner is fitted to augment the temperature of the waste gases if a high flash heat is required. This oven allows for continuous working, as the flame does not burn within the baking chamber. Extravagance is prevented, as the gas cannot be wasted through overflushing an empty oven, and even the most careless user must turn down the gas, or the brick bottom will become too hot to use.

*Externally Heated Ovens.*—These ovens are too expensive in running costs to be considered at the present time.

### COMPARISON OF COSTS IN GAS-FIRED OVENS.

It is very difficult to get careful comparisons, as the ovens are all being worked by different bakers. However, the following are figures from observations taken at several bakehouses where the conditions were as near alike as possible:

(Cost of gas at 10d. per therm, less 15 p.ct.)

*Internally Heated.*

No. 1.—The household type. Fuel cost, 42s. 6d. per ton of flour.
Goods baked—⅓ bread, ⅔ smalls.

*Internally Heated.*

No. 2.—Brick type. Intermittent baking.
Fuel cost, 40s. per ton of flour.
Goods baked—⅔ bread, ⅓ smalls.

*Part Internally Heated.*

No. 3.—Portable brick sole type. Continuous bakings.
Fuel cost, 25s. 6d. per ton of flour.
Goods baked—⅔ bread, ⅓ smalls.

Further experiments with this oven showed that continuous baking of bread only could be done for 30s. 8d. per ton of flour for fuel. The cost per working day averaged less than 2½d. per hour per oven, and the cost for fuel per £1 of goods baked (including bread) 5d. to 6d.

In considering these figures, there must also be taken into account the greater cleanliness of the bakery, the saving in storage space for coke, the absence of labour in handling it, and, of great importance to the "one man business," the saving of the time spent stoking up. After installing one of this last type of oven for a young baker just starting for himself, I called to ask him how it was getting on. "Champion," he said, "I'll get to the football match this afternoon for the first time for weeks."

It is perhaps even more important in small bakeries, where the "division of labour" system cannot be applied, than in large, that an oven should be capable of working strictly to time-table, so that bread may be got out in the morning in time to cool, and smalls in time for the afternoon tea business.

I am pleased to say that a great deal has been done in Newcastle to give increased efficiency and reduce the cost of gas firing, and in the near future there is still hope of further improvements.

### DISCUSSION.

The CHAIRMAN said he believed that in Newcastle they had built a number of the type of oven referred to—the firebrick regenerative type of furnace. He would like to ask Mr. Craggs if they had been able to compete with solid fuel, and as to how that type of furnace had compared in the cost of erection with a similar type of oven supplied by gas apparatus manufacturers.

Mr. J. E. MOFFETT (Sunderland) said he would like to congratulate Mr. Craggs on his paper and for explaining the question of bread-baking. It had to be pointed out, however, that before a baker would introduce a gas-heated oven, the first question he asked was: "To what extent can you reduce my expenditure on fuel?" This was a difficult thing to do, as cost was easily against gas as compared with coke. Speaking to a baker a few days ago, the latter eventually gave him some figures of his costs. Mr. Craggs mentioned 36s. per ton of flour; whereas the figures which the baker gave him showed only 6s. 6d. per ton. It would be a very difficult thing indeed to persuade that baker to introduce a gas-heated oven where he could show such remarkable figures of cost as had been given to the speaker. When the baker got down to 6s. 6d. per ton, it would take a very good man to persuade that baker to go in for gas. There was, of course, the question of cleanliness to be taken into account; but even after that comparison had been made, gas would be a long way out of it. Mr. Moffett was speaking of a "Morley" oven, which he said was one of the most economical solid-fuel ovens on the market, and was more easily managed than even the steam-pipe type. In the solid-fuel oven there was the banking-up at night; but gas would have to come down considerably before it could compete with 6s. 6d. per ton for fuel.

Mr. W. BATT, jun. (Newcastle), asked Mr. Craggs if he had had any experience with steam-saturated bakers' ovens.

Mr. CRAGGS, replying to the discussion, said he believed the cost of a gas brick oven and the cost of a coke brick oven would come out pretty much the same. He did not think there was anything to be said on either side. This was one of the reasons why they were trying to make gas-ovens portable. The foundations must be very much stronger for coke-ovens than for gas-ovens. Another drawback to the coke-oven was the coke dust. Every time they clinkered-up the fire the coke dust, which was very light, found its way into every corner of the bakehouse. The cost of the portable oven as against the coke-oven was to the benefit of the gas side, without a doubt. He cited a case where a man proposed paying £300 for a coke-oven; whereas Mr. Craggs would give him six portable ones for that amount. The £300 estimate did not include the excavation for the very strong foundation needed. The references made in the discussion to the cost of fuel raised very practically the whole purport of his paper, which was to try to bring the cost of fuel down. The sum of 6s. 6d. per ton was the lowest he had ever heard of. He had heard of three-and-a-half tons of flour to a ton of coke; and that was fairly good working. This came out at about 11s. 4d. With the coke-oven it had to be remembered that the baker had to turn out on a Sunday to stoke up; and this was of some monetary consideration, if the baker liked to have his Sunday at home. The stoking must go on, and sometimes twice on a Sunday. The "Morley" oven was, he knew, a very good one; but it had the same difficulty that he had explained—namely, that of getting the same temperature on the top shelf as that on the bottom shelf. It was portable, however, and easily moved about. The steam-pipe oven was hardly suitable for comparison. It had usually a brick foundation, and was a very big oven. The steam-saturated oven was termed the "Vienna" oven. The amount of moisture in an oven was a very important thing; and in this connection the gas-oven was favoured, because it gave a very dry heat. The saturated oven was only necessary for certain purposes and not for every-day baking. In a recent test they had baked in a gas-oven thirty 2 lb. loaves with 50 c.ft. of gas, which was less than a foot of gas per lb. of dough, as against thirty loaves for 80 c.ft. of gas in other circumstances.

The readers of the papers were heartily thanked.

The place and date of the next meeting were left to the Committee.

Mr. F. J. FALL moved, and Mr. W. L. ROBERTSHAW seconded, and it was agreed, that the hearty thanks of those present be tendered to the Chairman and Committee, and to the Secretary (Mr. A. H. Bagshaw) for their services during the past year.

## YORKSHIRE JUNIOR GAS ASSOCIATION.

### SELLING AND SERVICE.

At a Meeting of the Yorkshire Junior Gas Association on Saturday, Nov. 18, in the showrooms of the Bradford Corporation Gas Department—Mr. H. L. Bateman, of Wakefield, presiding—Mr. H. WILDE, of the Bradford Gas Showrooms, and Assistant Hon. Secretary of the Association, read a paper on "Selling and Service."

Dealing with what he termed one of the bugbears of gas men, he pointed out that a person gets at loggerheads with the whole industry simply as the result of buying a cheap and nasty burner from some one who has no connection whatever with the gas undertaking. How is this to be altered? By good reliable service, a co-ordinated policy throughout the whole undertaking, the creation of enthusiasm, a prize on optimism and a penalty on pessimism, and a host of other excellent morals and maxims one hears about. Why should not the business service be as well run and as intimately connected as our gas service-pipes? We pride ourselves on the way we can lay our pipes from the holders to the consumers' meters, we call them our "service" pipes; and what an appropriate name that can be! That the business service and the gas service are synonymous, must be apparent; but an irate consumer is more likely to forgive a stoppage in the gas service than he is one in the business service. This word service must be more widely known both inside and outside the undertaking. Make everyone in the department believe in it. A man who believes in service is a happy and contented individual; for "He who serves most serves best."

Before any set scheme can be attempted in co-ordinating each branch of service, enthusiasm must be created and firmly established. It is by creating enthusiasm, and subsequent concentration, that it is possible to convert every employee on the supply side into a potential salesman, besides being an ambassador of the department. Many employees are under the impression that, because they do not come under the direct selling side, they are not salesmen. It is true that every employee is not actually selling; but is this not because the word salesmanship is so wildly misconstrued? Even if apparatus is not being sold, service is; and the one can be as remunerative as the other. Though the principles of salesmanship are universal, their practical application in a gas undertaking is vastly different from (say) a chemist's, simply because the sales of gas and gas appliances are not in any way confined to one particular department of the undertaking—which in itself is a very good point, if cultivated successfully. Successful cultivation is the interlocking of one department or one section of a department with another, whereby every operation of the selling side forges a link between the consumer and the actual sale, and between the sale and continued usage. If the policy of the department is made known, a wide variety of men in the form of plumbers, fitters, clerks, inspectors of all kinds, &c., can be salesmen. A gas undertaking is obtaining entrance to at least 80 p.ct. of the private and business premises in its area of supply; and with what results?

It can hardly be expected, however, that, for instance, a meter inspector, or clerk, or workman in the mains section has the opportunity, in addition to his ordinary duties, of educating the public in the interests of gas. Perhaps it is not advisable for a man not wholly connected with the sales, installation, or maintenance of gas appliances to attempt to do so; but it must be a first and foremost duty of every employee to report complaints and inquiries. Complaints and inquiries must be interlocked with service and sales, as must also the outside with the inside staff.

### THE GAS SALES DEPARTMENT.

The creation of a special sales department is an idea quite modern, while the scientific organization of selling is more recent still. Not only must people be able to obtain our appliances,

they must be taught to want them; and salesmanship is still the art of teaching people what they want. Years ago we were satisfied to put gas in the mains and finish at the meter with a take-it-or-leave-it policy; but to-day we must not regard the meter even as the starting-point. We must begin at the point of consumption. Reconstruct the entire old procedure, and find out every possible point where gas can be efficiently and satisfactorily used in conjunction with any of the numerous gas appliances at our disposal. Start there, and co-ordinate the policy right back, stage by stage, to the holders; and when the system is efficient, do not be surprised if it has necessitated the enlarging or building of new gas-making plant. Our selling policy, therefore, operates from the time the gas is in the mains and the appliances are in the showroom until the consumer is supplied—not merely the actual use of the gas and the purchase of an appliance, but every business move that contributes, so that the whole is welded together into one coherent and purposeful organization.

The creation of a gas sales department having efficient supervision is desirable, because complex and varied questions of what should, and what should not, be included in the selling scheme have to be decided. It seems, however, perfectly easy to arrive at a decision on this point, if we remember that every time we come into contact with a consumer, whether he be past, present, or prospective, we make an impression, and that impression is good, bad, or indifferent. When it is considered that the personal touch of the undertaking is on the finger-tips of every employee coming into contact with the public, the number of influences capable of making that impression are indeed very great—varying, of course, according to the size of the undertaking. The impression either helps to sell or raises an objection between the consumer and ourselves, or it fails to advance our cause. It follows that every advertisement in the Press—whether our own or one of the "B.C.G.A."—every poster, every label used on our appliances, our notepaper, our salesmen and their methods, the following-up of inquiries and complaints, the delivery and the fixing systems, the method of rendering and collecting accounts, everything which helps to build-up that confidence between the consumer and the undertaking, requires to be considered under the heading of salesmanship.

### Salesmanship.

To sum-up the elements of salesmanship—that is, the art of promoting maximum sales with the maximum amount of mutual satisfaction—salesmanship can be learnt; the salesman can make himself progressively more efficient. Behind the successful sale must be a well thought-out sales policy; behind the successful salesman must be developed strength of character. The salesman must have 100 p.ct. enthusiasm. He must have self-confidence, persistence, determination, hope, courage, cheerfulness, and optimism. All these are essential qualities of salesmanship. It is only the haphazard salesman who becomes flurried, confused, baffled, and finally squashed. The salesman who does not know what he is driving at soon gets pushed off his object, and the sale, instead of being carried out along a well-thought-out reasoning channel, proceeds as the customer wishes, and not as the salesman directs.

There are three magic words of salesmanship: Listen. Agree. Oblige. But the average untrained salesman does not know the power of these words. Usually he has three others: Talk. Argue. Compel. These three words have spoiled many a sale, and lost many a customer. Of course, a salesman should not surrender to a customer; but he should avoid all appearance of compulsion. One art of salesmanship is in getting the customer over to your point of view without pushing him, and the secret of doing this is really to desire to be helpful both to the customer and to the undertaking. Don't argue—illustrate. It is of no use making exaggerated statements regarding any appliance; neither is it of any advantage to sell a consumer a piece of apparatus totally unsuited to his needs.

We must not talk price—talk quality, even though the price is low. We must not run-down our competitors' goods. Talk the "reason why" of our own goods. We must not make any extravagant claims, nor make any promise that is not going to be fulfilled to the letter. Our consumers must be educated into knowing that our offices and showrooms are information bureaux. We must get them to call, to inquire about, and inspect any of the appliances without being importuned to buy. When they do call, we must encourage them to talk—in fact, we must make them talk, because it is only by this means that we can get first-hand information as to their views and requirements. Modern salesmanship is not talking; it is listening. From a personal standpoint, the salesman must realize that there is a recognition that fine salesmanship is an honourable occupation, well worthy of being accepted as a life career, and one which entitles the salesman to a definite status and to satisfactory and substantial remuneration.

### Office Organization.

We have opportunities of developing the sales of gas and gas appliances in a very wide field; and if we desire satisfaction, efficiency, and reliability in every branch of service, we must adopt up-to-date business methods, cultivate business ability, combine it with the usefulness our commodity offers, and work it for all it is worth. Do not be afraid of inaugurating new systems; but be careful not to over-organize. Pay strict attention to the offices, so that, instead of being a place in which to write letters and keep books—a sort of necessary nuisance—they become the pivot of the whole undertaking.

Liken it to the General Post Office, and let the different sections of the department resemble pillar-boxes into which inquiries, complaints, memos, &c., are put. Empty the pillar-boxes to the "G.P.O." sort, and route the contents to their respective destinations. Now that these reports are coming through a central channel—the clearing office—let all inquiries, complaints, and reports themselves (which for the purpose of this paper we may style "needs") also come through an organized central channel—the "Need Forms." Prepare cards setting out under an easy-to-follow number system what is needed at any address. Issue a card to each employee. "Needed" covers the whole of the supply side, whether it be a stoppage, faulty light or stove, the possibility of an order for a fire or a cooker, or even the supply of fuel to an existing fire. Each morning a suitably printed form is handed to every man on the supply side, with instructions to keep his eyes and ears open and report on the form the address and the number of the needs. An arrangement whereby all urgent needs (escapes, stoppages, &c.) could be telephoned from the district to the clearing office should also be made.

It is only by a system such as this that it is possible for the management to be kept alive to all the possibilities of sales and changes and to the full knowledge of complaints. The forms can be tabulated and records kept of the number of needs reported by each man. The results will point to the enthusiastic members of the staff, and will also prove a sure promotion guide, as opportunity arises. A census of all the premises in the area of supply, together with the appliances in use, is most desirable, and the "need" method will always keep the census alive. In all cases of reports on "Need Forms," where a representative of the sales department (salesman, inspector, fitter, &c.) is required, the person deputed to attend to the need and fulfil the consumer's requirements can be supplied with the census information; and while he is primarily attending to the need, he may at the same time be interesting the consumer in some other form of gas usage.

### Improving the Staff.

This method would open-up another avenue, that of educating the staff. Short lectures can be given—perhaps by members of the makers' technical staff—with the sole idea of making all concerned conversant with every new piece of apparatus. Monthly conferences of foremen of all sections of the supply side are a great advantage. The exchange of text-books, trade journals, "B.C.G.A." publications, makers' reports on efficiencies of appliances, papers read at senior meetings, conferences, &c., is well worthy of adoption. Every possible avenue should be pursued by the management for supplying literature and data to heads of sections on the supply side, and a carefully supervised list of interchange should be kept by the sales manager, who would be responsible for each of his subordinates studying the publications. It is a pleasure to note in the Technical Press reports on the formation of salesmen's conferences. These are a step in the right direction.

The issue of weekly talks on salesmanship is very helpful—at least it has proved so in Bradford, where the selling staff have received great benefit from articles issued by the Sales Manager. These "selling talks" are capable of being extended. If such a system of instruction and encouragement will prove advantageous to salesmen, then it is able to be of service throughout the whole of the supply side. Some of the larger undertakings are fortunate in having already established a "Gas Department Magazine," and this course seems worthy of more general adoption. In smaller concerns it need not be printed—a mimeographed record would do; but for the larger undertakings a printed booklet could be introduced fairly cheaply. A "Gas Department Magazine" can be brought to the greatest perfection where the undertaking bears the cost, or, failing that, where the expense can be distributed over a great number of employees. In a small concern the four-page folder will find its place, and no staff is too small for the duplicated sheet. It must be remembered, moreover, that the whole staff takes the keenest interest in such a publication, and subject-matter can be included to suit all. As an incentive to increased efficiency, sales, and harmonious working, a "Gas Department Magazine" cannot be estimated.

### Advertising.

The admirable illustrated advertisements issued by the "B.C.G.A." make attractive and interesting copy in many periodicals and newspapers, and from a national standpoint the gas industry's advertising is good. If some local chain of action is coupled with it, the results will certainly be improved. Any business to be made a paying concern must advertise, bring its goods before the public, and await results. They will not fall suddenly from space; but the author does not know of a single case where consistent advertising, coupled with efficiency of goods and service, has not paid.

Mr. Wilde then went on to explain at length one scheme in this connection recently successfully completed in Bradford; the appliance to be sold being a gas-heated washing machine. A free demonstration at the showrooms was prominently advertised in the local Press, letters on the subject were addressed to likely customers, and in the showroom window two of the machines were displayed, with accessories. The campaign was keenly pursued, and a satisfactory number was sold. Similar demonstrations of gas-fires, gas-cookers, gas water-heaters, &c., could no doubt be carried out effectively; and it is impossible to say where or of what size a crop will be reaped from the seed that can be sown at these gatherings.

### THE SHOWROOM WINDOW.

In connection with any kind of demonstration, there is one form of advertising which most undertakings enjoy at little or no extra expense, and that is the showroom window. The value of a window in a shopping area, where hundreds of people must pass each day, cannot be over-estimated. While it should be remembered that advertising can almost compel people to visit the showrooms, when they arrive there they largely judge the showroom by its outward appearance. An association of ideas capable of making an impression on the minds of prospective customers should be aimed at in all questions of window display. The window must be the last word in everything new.

### SHOW-CARDS.

The importance of display show-cards was emphasized. Those used in Bradford are plain oblong cards giving definite information—many of them arousing curiosity at a glance, others stating precisely and conspicuously the selling price or hire-purchase terms, as the case may be. Observation has been kept on the cards from outside, and their "pulling" power is enormous. Many times passers-by have reached the corner of the showroom window, and have turned back to read the particular card displayed, and then glanced at the cooker or other appliance referred to on the card. Sales have included appliances referred to not by name, but by the show-card advertising them—a sure proof of the worth of this means of advertising.

### DISCUSSION.

Mr. N. SAMPSON SMITH (Ossett) admitted the idealism of the suggestions put forth, but reminded the members that the gas department had to develop a sales organization which must, necessarily, depend on its available resources and its scope. A selling campaign had been organized recently in his own town. A card was allotted to each consumer, detailing the appliances already in use, and other useful information. The whole supply area was divided into districts, and then the districts were tackled in turn; the consumers being first circularized with "B.C.G.A." pamphlets, according to their particular needs—as disclosed by the card—followed by visits by a canvasser, who took careful note of any complaints at the same time as he sought and booked orders. By this system, he had been able to compile some statistics pointing to the close relationship between salesmanship and service. In all cases where the percentage of complaints was high, the percentage of sales was correspondingly low. This showed in practical form the necessity for the best possible service, if a campaign was to yield good sales results. The experience of the few months in which their campaign at Ossett had been in progress showed that the public were in need of education as to the use of gas.

Mr. W. HEATHCOTE (Halifax) asked Mr. Wilde how far he thought free service should be extended. In Halifax they had done a good deal of this. Undoubtedly it had great advantages; but it was not done without cost, and he would like other opinion.

Mr. WILDE said service in cleaning and regulating cooking, heating, and water-heating apparatus in Bradford was free, but lighting service charged. There was a system of maintenance of incandescent burners, which worked-out fairly cheaply to the consumer. He thought the subject of general free service was a big one, and one the merits and demerits of which should be considered by each undertaking according to its circumstances. The cost of general free service must come from the revenue from gas; and it was a matter for individual choice as to how far it should go.

Mr. C. T. B. ROPER (Bradford) urged that something ought to be done in regard to lighting service, and particularly shop and shop-window lighting, much of which did no good to the reputation of gas as an illuminant.

Mr. F. LODGE (Wakefield) said in his town they had recently instituted a new lighting scheme; men being sent round to regulate burners, and where those in use were out-of-date or otherwise deficient, to recommend new ones.

Mr. S. T. S. MUSGROVE (Sheffield) commented appreciatively on Mr. Wilde's comprehensive application of the word "salesmanship" and his association of it with "service." He emphasized the urgent necessity for the fullest education of gas salesmen, and drew attention to the conferences on salesmanship which were part of the programme of the Electrical Development Association. Their salesmen, he had noted, were carefully warned not to talk technicalities to the consumers, and not to make comparisons in cost as between gas and electricity, though it was well-known that, in the effort to secure a cooking and heating load, the electrical people were prepared to sell current at about cost price. Gas salesmen should keep themselves fully conversant with what their competitors were doing. Their cooking and heating load was the envy of the electrical people; but the gas industry could not afford to relax its efforts and its watchfulness. The question of cost, whether of securing or of using the appliances, was in the gas industry's favour every time; and he strongly recommended that salesmen make a strong point of discussing comparative costs with the public at every opportunity.

Mr. E. L. OUGHTON (Huddersfield) commented on what he regarded as a contradiction in statements in the paper. Mr. Wilde had included as "salesmen" a large number of gas department workers, by virtue of the service they rendered; yet he went on to express gratification at the holding of salesmen's conferences, which were, of course, merely for a selected proportion of the wide number of employees concerned in salesmanship and service as a whole.

Mr. WILDE said that he understood the privilege of attending these salesmen's conferences was by invitation, and he supposed these invitations would come from the engineer or manager of the undertaking concerned. He still held that everybody who rendered service was a salesman in a sense; but it was obviously impossible to have selling conferences including all these people. If salesmen conferences were attended by one or two representatives from an undertaking—especially those in most immediate touch with the buyers of the apparatus—any knowledge or experience gained could be imparted to their own sales staffs subsequently.

Mr. J. R. FIRTH (Bradford) pointed out that service after the sale was just as essential as service before the sale. They had found in Bradford that when the season of gas-fire use arrived consumers ordering new fires demanded immediate fitting. The salesman was required to promise quick delivery and fixing; but if he gave a promise which the transport department proved unable to carry out so quickly, the result was at once a discontented consumer. In the past there had been complaints of the time spent on jobs by fitters; but this had been practically overcome by having a man to estimate the fittings required, thus enabling the storekeeper to assemble the materials in advance, and the fitter to get to the consumer's address without undue delay. This arrangement saved the consumer's money, and was therefore appreciated; and it also saved valuable time in the stores.

Mr. C. R. INGHAM (Brighouse) said the service must extend right back to the gas-works. The best possible salesmanship and supply of internal fittings would fail to give satisfaction unless the undertaking supplied a gas of constant calorific value and at a good and constant pressure. Wherever possible, gas undertakings should carry out internal fitting; and in other cases there should be a standard specification to which plumbers should be required to work. A valuable feature in any showroom would be a test meter to prove to a prospective customer the actual consumption of any type of burner or appliance. A meter which showed hourly consumption by an observation of one minute would render valuable service.

Mr. S. H. PACKER (Bradford) congratulated Mr. Wilde, who was of the department of which he (Mr. Packer) had the management, on his excellent paper, and its practical exposition of the author's own attitude on the question of scientific salesmanship. As Mr. F. W. Goodenough had pointed out quite recently, there had been remarkable development in selling methods in the gas industry during the past twenty years. It was the law of averages that counted in salesmanship. Selling gas and gas appliances came chiefly under the heading of speciality salesmanship, and could be grouped under four stages. The first was that of pre-approach—the groundwork of a sale. It included knowledge of self, knowledge of one's goods, and knowledge of the other man. It embraced the training of the selling staff, the holding of salesmen's conferences, and all means by which the salesman was better equipped for his work. The second stage was that of the approach, including diagnosis of the customer and the pleasant greeting, courtesy, and enthusiasm displayed in dealing with the inquiries. The first impression the customer received of the salesman was naturally, owing to the short time they were in contact, a lasting one, and went far to make or mar a sale. The third stage was that of demonstration. Customers liked to handle the goods themselves, and to see them working. Many sales were made by careful suggestion. The fourth stage was the "clinch." When the right moment came, the salesman should finish demonstrating and try to close the deal. He should never talk a prospect out of buying. He should use the thin end of the wedge of salesmanship first, and then ram home the thick end. Advertising went hand in hand with selling. Nothing was too good to advertise. Good advertising was based on one simple foundation—that of telling the people all about it. If it stuck to this basic idea, no advertising could fail. Good as was the "B.C.G.A." advertising, it had to be supplemented by, and co-ordinated with, local advertising, which should be specific instead of general. Advertisements should be clear, concise, easy to read, and have plenty of white space. The showroom window was perhaps the best advertising medium in the hands of the gas department, and should be such as to compel attention. Most ordinary shop window displays lacked individuality. Freak windows, he held, were not necessary, or even advisable; but displays arranged in a manner which would educate the public into the uses and advantages of each appliance, while interesting them sufficiently to make them stop and look, were valuable. Window cards should be in conversational style, and yet have a "punch" in them.

The PRESIDENT said he was with Mr. Wilde in feeling that each undertaking would have to settle the question of free service on its merits. Absolutely free service, of course, could be grossly abused, and this was a danger which must be avoided. The "Need Forms" suggested by Mr. Wilde would ensure the recording of complaints and requirements and of new business in a concise manner, so that reference to the requirements of any consumer could be made at a glance. This was distinctly a step in advance of the census forms used by some undertakings. Any method to save writing by the fitter was a great time-saver. The forms would do much to preserve the goodwill of consumers and bring into use gas apparatus of which the consumer had hitherto been ignorant. The utmost attention should nowadays be given in every town to public demonstrations and lectures, as was done in Bradford.

Hearty votes of thanks were accorded Mr. Wilde for his paper, and to Mr. Charles Wood for placing the showrooms at the disposal of the Association.

On the motion of the PRESIDENT, all members rising in respectful silence, a vote of condolence was passed with the relatives of the late Mr. G. H. Crowther, of Heckmondwike.

## A Two-Thousandth Number.

With the number of the present "JOURNAL" standing at 3107, and having served the gas industry 74 years, we can give the "Gas World" a hearty slap on the back on the occasion of the publication of its 2000th number, and its 38 years' work in the industry. We do so with the greater cordiality, because of personal relationships. The first two editors of our contemporary—Mr. John Allan and Mr. James Stewart—were, prior to their association with the "Gas World," both identified with the "JOURNAL" as news correspondents—the former in Scotland, and the latter in the Manchester area. We sincerely wish our contemporary a long life of good work.

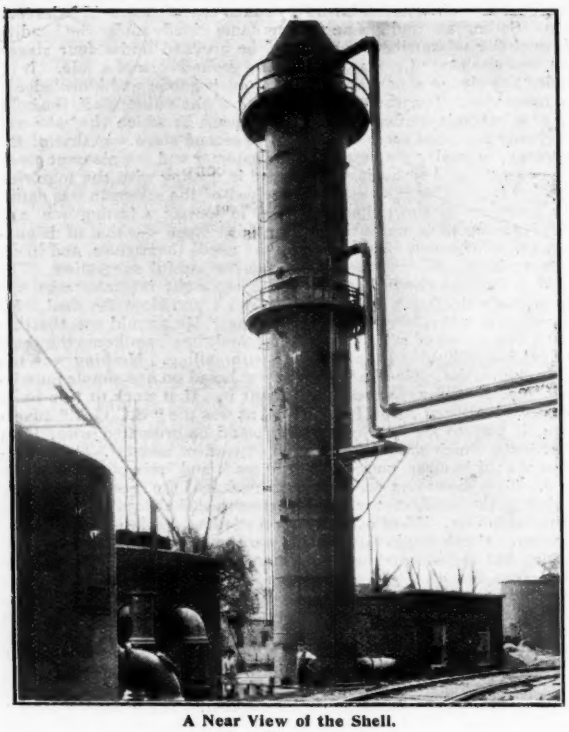
# LIQUID PURIFICATION AT BATTLE CREEK.*

By F. W. SEYMOUR,

Vice-President of the Battle Creek Gas Company, Michigan.

Due to a peculiar combination of conditions, the problem of purifying gas at Battle Creek has been a subject of serious study during the past several years. A big percentage of industrial gas going to large consumers has compelled us to manufacture nearly all coal gas. Water gas has been, and apparently will be, more and more out of line in cost of production to enable the gas companies to use it to meet the highly competitive field of industrial fuel. Owing to this disadvantage and the consequent making of increasingly larger volumes of coal gas, the industrial fuel gas situation has further complicated the production problem and magnified its effect on the subject in hand. This large industrial output, added to an already imposing general and domestic output, has made our sales *per capita* the largest of any city in the United States. Making nearly 100 p.ct. coal gas has in turn made an enormous coke output *per capita*. This has necessitated the selection of coal for carbonizing almost entirely from the standpoint of coke structure and quality. Experience has demonstrated very forcibly that the use of coals which do not coke into the firmest and hardest structure has resulted in considerably higher conversion costs.

A few such experiences have established a policy of coal purchase not susceptible to deviation. Unfortunately, however, the coal which in our equipment produces the coke of best structure and size with the smallest amount of breeze and unsaleable fines,



A Near View of the Shell.

is apparently becoming less dependable as to its sulphur content. Not only has the average sulphur in the best coking coals increased, but there have been sporadic instances of high sulphur which produced gas impossible of complete purification by the inflexible oxide method. I have in mind one period of two months in 1920, when the fuel administration zoned-off our coal supply to a certain mine which had run into an area of high sulphur, and during which time the raw coal gas at the plant varied between 700 and 900 grains $H_2S$. Under this condition, naturally oxide purification broke down.

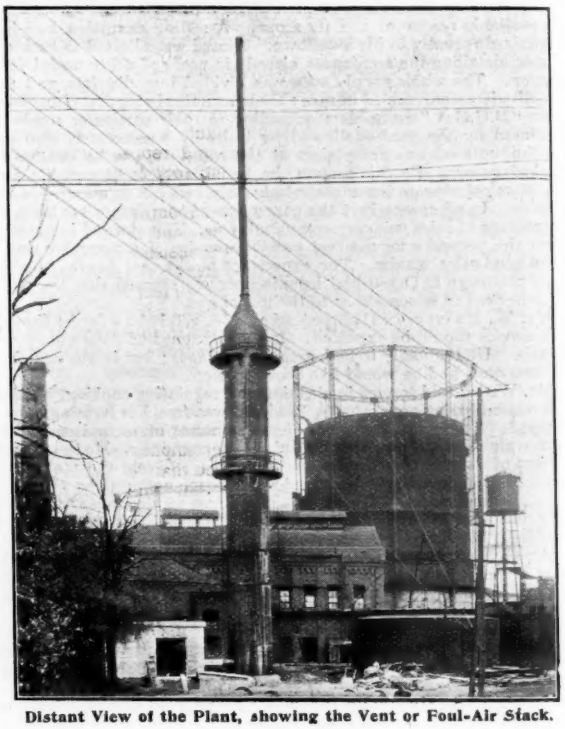
### CORROSION AND MORE EFFICIENT PURIFYING PLANT.

As a consequence of this and other experiences of like nature, though frequent additions were made to our oxide plant, and every ingenuity possible exercised in its operation, evidences of the need of a more flexible and efficient purifying plant developed. With the dropping of heating standards in recent years, unlooked for corrosion of mains, services, and meters (particularly meters) has increased. At our Company this became alarming, and an investigation pointed to the culprit as being hydrocyanic acid. This cyanogen trouble is not peculiar to Battle Creek, as a great amount of research here and abroad testifies to the seriousness and widespread existence of it. The literature of the industry has touched on this with greater frequency of late, and it is very apparent that it is one of the most important technical problems of the industry to-day. Though the trace of sulphur compounds escaping past the oxide boxes caused a noticeable odour at times from the rapidly increasing number of room heaters used by our consumers, and though these same traces were in other ways noticeable and objectionable, the principal and most important reason for the selection of this plant by us was the seriousness of cyanogen corrosion. And, if you will pardon the presumption, it is a problem all of you will have to meet sooner or later.

### LIQUID PURIFICATION.

These facts have been recited so that the most important reasons for installing the first liquid purification process of this kind in a gas plant would be apparent. The Koppers Company had previously developed, and had had in operation for about one year, its liquid purification plant at the Seaboard Coke Oven Plant. In spite of the splendid record of performance there, and the certainty of duplication of these results at Battle Creek, the contract with the Koppers Company for a 2,000,000 c.ft. per day plant was signed by us with some fear and prayers. There seems inherent in our industry an unholy fear of trying-out something new, as the path of the pioneer is frequently not a pleasant one.

I will not take your time to give a minute description of the plant, nor an exhaustive, technical discussion of its operation, strongly as I am tempted so to do. At last year's meeting of the American Gas Association, Mr. F. W. Sperr, Junr., of the Koppers Company, read a paper describing the Seaboard installation, and quoting ample supporting data. Mr. Sperr's splendid paper, for which he was deservedly awarded the Beal medal, thoroughly exhausted the subject, and is a reference work on liquid purification. Undoubtedly, all those present and interested have read the paper,



Distant View of the Plant, showing the Vent or Foul-Air Stack.

and I will, therefore, not attempt clumsily to review that which has been so ably presented before.

### THE "SEABOARD" PROCESS.

To refresh your memories, however, the Koppers or Seaboard liquid purification process has as its principle of operation the use of a dilute aqueous solution of sodium carbonate, or soda ash, to remove the sulphur compounds from gas by scrubbing contact with it. After such scrubbing, the foul solution is revived by the very simple means of blowing air through it, and is again used for sulphur absorption with no other treatment. To provide the proper scrubbing conditions, the soda solution is circulated through two cylindrical towers very similar to those in use for cleaning gas in both coal and water-gas plants. The solution is pumped to the top of the tower and distributed over the cross section of the shell by a set of sprays. The tower is of such height as to give ample time for scrubbing contact between the descending streams of liquor and the ascending gas in one case and ascending air in the other. The wetted surface is made up of trays, spiral tile or coke; in our case tile being used on the theory that a maximum of scrubbing surface per cubic foot of tower volume is achieved with them. It is now proposed to use coke; it being vastly lower in first cost, and equally, if not more, satisfactory from the standpoint of scrubbing contact. In fact, a portion of one of our shells four feet high has been refilled with coke instead of tile hurdles with apparently beneficial effects.

To simplify the plant and eliminate an extra set of pumps, our

* A paper read at the Annual Meeting of the Michigan Gas Association, Sept. 15, 1922.

towers were combined in one shell, the dimensions of which are 8 ft. 6 in. in diameter by 87 ft. high, made of tank steel. The tower, into which the air is blown at the bottom, is 42 ft. high, having 20 in. inlet air nozzles at the bottom in duplicate, and a 20 in. off-take or vent at the top. A horizontal bulkhead at the 42 ft. level separates the actifier and absorber, the latter occupying the remaining distance of 45 ft. The inlet gas connection, by which the raw gas enters the plant, is at the bottom of the absorber some 44 ft. above ground level, and the outlet which delivers the treated gas to the oxide catch-boxes is at the top of the shell. The two sections are filled with tile, except enough space at the top of each compartment to permit the installation of sprays and proper distribution of the solution. The vent, or foul air off-take from the actifier, previously mentioned, forms a stack above the shell and extends above it 38 ft., or in all 125 ft. above the foundation, discharging into the atmosphere.

By combining the two phases of the process in one shell, only one pumping system is required. This consists of a reciprocating steam pump of oversize capacity, so that its operating speed is very slow. It is equipped with a speed regulator and a Venturi meter. A duplicate pump and regulator is also installed. The soda solution is pumped from a concrete sump to the top of the tower, and is sprayed over the wetted surface of the absorber. At the bottom it is collected and enters the actifier through a sealed delivery pipe, and thence through the sprays into the actifier. A fan delivers air to the actifier, being installed in duplicate; one being steam driven, the other electrically. Soda is dumped into the sump daily, so as to maintain the solution at the required strength.

### Working Experiences.

The plant has been in operation since June 15. It has run since without any special supervision or attention. No extra labour is required to look after it. The only expense of operation is the cost of the soda consumed, and the steam and maintenance required by one small fan and pump. Attached are a performance log for the first twelve weeks of operation, and an estimated cost of operation for the plant. Our actual cost of purification is less than this estimate, and represents a saving of nearly 1 c. per 1000 c.ft. over 1920 and 1921 costs.

It may be of interest to mention that this plant was put into operation on coal gas only. Nearly two months ago water gas was put through it along with the coal gas, and it has functioned equally well on the mixture. Some apprehension was felt that such would not be the case, as our water gas is only partially cleansed before entering the purifiers. We feared that the tar and oil scrubbed out by the solution would lessen its activity, but such has not been the case, though a considerable accumulation of heavy tar collects in the sump, and has to be bailed out occasionally. It looks as if this equipment has not only met our purification difficulty, but has saved us the cost of a water-gas scrubber as well.

I regret exceedingly that the coal strike has interfered with our regular coal supply, so that gas of higher sulphur content could not be treated; but we are fully satisfied that the performance would be equally as good as, if not better than, that above quoted, when operating with raw coal gas carrying up to 1000 grains of $H_2S$ per 100 c.ft.

### A Complete Cure for Meter Deterioration.

To date all indications point to a complete cure of meter deterioration due to cyanogen. The condition reports of our meters, as evidenced by the tests made in our meter shop since June 15, show a splendid improvement. Hydrocyanic acid analyses of our purified gas confirm these, as the content of cyanogen in the finished gas is very low. More time will, however, have to elapse to determine beyond all doubt whether this hoped-for result has been achieved.

### Other Advantages.

There are several advantages in this liquid purification plant worthy of mention besides the elimination of cyanogen corrosion and the not inconsiderable saving in operating expense.

The saving in ground space is one item which, to many plants is a very important one. Not only is the ground area required for the shell and pump house vastly less than that required by a battery of oxide boxes of equivalent capacity, but more important still is the saving of ground area required for making and reviving oxide. It is a notorious fact that gas plants are generally located in crowded districts where ground area is valuable and in many cases impossible to procure.

Safety of operation with a liquid purifier equipment is an advantage that cannot be minimized. Of the many serious accidents to life and property at gas plants, unquestionably a vast majority have originated in purifier houses. You are all too familiar with the dangers surrounding the changing of boxes to necessitate amplification of this feature. With only partial purification, as this system is being used at Battle Creek, we estimate that it will be necessary to change boxes only once in several years, and then ample time will be available to make such changes thoroughly safe.

Owing to the universal use of oxide purification, this liquid process will not have the full advantage of low cost of installation to which it is entitled. Engineers, in equipping their plants with this system, will be compelled to have an investment for two plants on account of the existing oxide boxes. With an entirely new installation of purifying equipment, however, either liquid purification combined with oxide for catch-box service, or complete liquid purification, will show a considerably less investment per unit of capacity as against a complete oxide plant.

Though the saving in reduced back-pressure due to the process may be computed as a credit in cost of operation, other savings may be caused by it. In a rapidly growing plant, it may dispense with or at least defer the necessity of purchase of higher pressure exhausters. By virtue of the elimination of an average of 15 in. in back-pressure due to our oxide boxes, we have permanently shelved the consideration of new exhausters at Battle Creek.

Savings in labour may be accomplished over and above that appearing in the cost records. Frequently, round gas-works with oxide purification, men who are accustomed to the special work of changing boxes and preparing material are kept employed at other work between times to have them available, though their productivity is low at other duties. In this connection, the routine work of the plant frequently suffers, due to the necessity of quickly changing boxes when least convenient to the plant personnel.

### Reliability and Simplicity.

The reliability of the liquid system is a considerable advantage. The raw material, sodium carbonate, is cheaply and easily procured in sufficient quantities to protect the plant against future contingencies, which is not true of oxide. Also the operation is far more precise than with the older method. Sodium carbonate is a definite chemical compound, the chemical reactions involved in its use are exactly and precisely known, and the operation of the system can be most accurately predicted and controlled, In the case of oxide, none of these facts holds; and doubtless all of you have had experience with oxide which has demonstrated the fallibility and lack of uniformity of this material.

### Flexibility of the System.

Heretofore the word flexible has been used in several places. To my mind, this is one of the worthwhile features of the liquid purifier, allowing as it does great flexibility in handling wide variations in the flow of gas to be treated and the amount of sulphur contained in the raw gas. A shipment of coal high in sulphur content may come in at the plant, and the only expedient required is to increase the speed of the pump and the fan. The equipment is liberally enough designed to take care of severe overloads of this nature, which is certainly not true of oxide purification. This is particularly à propos where water-gas reserve units are thrown on the line suddenly, resulting in very large volumes of gas to be purified for short periods.

### Ability to Use Coals of High Sulphur Content.

The greatest advantage from a financial standpoint of this equipment, and one which, next to the cyanogen corrosion difficulty, was given the most consideration at Battle Creek, is the ability to use high-sulphur coals. During these turbulent times of transportation failures, a wider field from which to purchase coal is certainly a very tangible and distinct advantage. Frequently, too, if purchasing coal on the open market, high-sulphur

Exhibit "A."—*Weekly Log of Liquid Purification Plant (Battle Creek Gas Company).*

| Week Ending. | Total Gas C.Ft. for Week. Thousands. | Average per Day C.Ft. Thousands. | Grains $H_2S$ per 100 C.Ft. | | Percentage Removal. | Lbs. Soda Consumed per Week. | Lbs. Consumed per 1000 C.Ft. | Lbs. $H_2S$ Removed per Lb. Soda. | Rate of Solution Gal. per 1000. | Rate of Air C.Ft. per Gal. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Average Inlet. | Average Outlet. | | | | | | |
| 6-21 | 9105 | 1300 | 258 | 24 | 90·4 | 426 | 0·047 | 7·16 | 60 | 60 |
| 6-28 | 8629 | 1233 | 269 | 23 | 91·6 | 272 | 0·032 | 11·15 | 64 | 70 |
| 7-5 | 8559 | 1223 | 260 | 23 | 91·1 | 179 | 0·021 | 16·00 | 62 | 63 |
| 7-12 | 9219 | 1317 | 294 | 25 | 92·2 | 291 | 0·032 | 13·36 | 56 | 75 |
| 7-20 | 9371 | 1390 | 308 | 25 | 91·3 | 276 | 0·029 | 13 7 | 60 | 75 |
| 7-27 | 9830 | 1404 | 298 | 24 | 91·8 | 255 | 0·027 | 15·6 | 55 | 78 |
| 8-3 | 9571 | 1367 | 335 | 36 | 89·2 | 272 | 0·028 | 21·8 | 59 | 62 |
| 8-10 | 9459 | 1351 | 308 | 26 | 91·5 | 213 | 0 023 | 15·5 | 57 | 68 |
| 8-17 | 8504 | 1215 | 263 | 24 | 90·9 | 117 | 0·014 | 21·05 | 56 | 75 |
| 8-24 | 8439 | 1206 | 230 | 20 | 91·5 | 470 | 0·056 | 5·43 | 58 | 72 |
| 8-31 | 9510 | 1358 | 196 | 18 | 90·8 | 221 | 0·023 | 10·5 | 58 | 71 |
| 9-7 | 8620 | 1233 | 248 | 22 | 91·2 | 122 | 0·014 | 23·2 | 53 | 78 |
| Average | 9068 | 1341 | 272 | 24 | 91·1 | 259 | 0·029 | 14·54 | 58 | 71 |

coals can be procured at a discount over the low-sulphur variety, and in every other respect be suitable for gas production. It is easy to see that an inconsiderable tonnage of coal purchased below the market on account of sulphur content will rapidly return the cost of a plant of this kind. In the long run, too, cognizance must be taken of the necessity for using such coals as available, and especially low-grade ones, which may be at a lower freight rate on account of proximity to your plant. Apparently, this tendency will increase with the time rather than decrease; and a plant equipped to handle coals with virtually no limiting sulphur content will be vastly better off to render service at cheaper rates than those that are not.

### NAPHTHALENE.

There is no apparent effect on naphthalene removal due to the liquid purifier installation. Our observations to date indicate that this will be effected only by temperature changes in the apparatus, and is not on account of the nature of the process, but purely by virtue of the heat interchange brought about by the shell. We do not believe from our limited experience that it is advisable to have an excessive drop across the liquid purifier, as this will have some effect on the efficiency of the sulphur removal and throw considerable amounts of naphthalene in the sump, where it is not as convenient to handle as in other apparatus.

### THE ONE DISADVANTAGE.

It would not be fair, after quoting the many advantages, to ignore the one disadvantage of the system, which immediately comes to each gas man's mind in looking over the process—that is, the question of odour in the foul actifying air emanating from the vent pipe. This question was carefully discussed with the Koppers Company before the plant was installed, and the experience at Seaboard indicated that no objectionable odour would be noticed. However, the plant at Battle Creek is located in the heart of the city, and some complaints from neighbouring residential districts have been received. They have not been serious enough to cause grave concern; but to eliminate any cause for complaint, we have decided to pipe this foul air to the boiler-house and put it under the grate bars of the boilers, which work is now being done. Beyond all doubt, this will eliminate the odour, and in a satisfactory manner. It is probable that there are very few plants located as disadvantageously as ours from this standpoint. Apparently the oil vapours, since water gas was introduced into the purifier, are more obnoxious than the hydrogen sulphide removed from the coal gas.

We are thoroughly pleased and satisfied with the performance of the plant, and believe it to be one of the most welcome steps of progress in the industry which has been made for some time. Contracts for several very large installations have been closed since the Battle Creek plant was installed, and at least partially on account of it, which is gratifying in that additional confirmation is thereby established of our judgment in the selection of this equipment to solve our purifying problem.

### THE BRITISH RIGHTS.

Messrs. Woodall, Duckham, and Jones (1920), Ltd., of No. 52, Grosvenor Gardens, London, S.W. 1, have acquired the British rights for the process described above, and have arranged for a plant to be erected at once on a medium-sized works which will deal with 750,000 c.ft. of gas per day. In this case the plant, while capable of eliminating the whole of the $H_2S$ present in the gas, will only be called upon to reduce it to about 0·1 p.ct., and the present oxide purifiers will complete the extraction. The process is being tried-out on account of its positive nature, its low capital cost, the small ground space occupied, and its ease of mechanical operation.

Full information can be obtained from the above Company concerning the details of this process.

EXHIBIT "B."—*Estimated Cost of Liquid Purification (Battle Creek Gas Company).*

Capacity 2,000,000 c.ft. per day.

| — | Per Day. | Per 1000 C.Ft. | |
|---|---|---|---|
| | $ | Cent. | Pence.* |
| Soda ash, 60 lbs. per day at 2 c. | 1·20 | 0·060 | 0·03 |
| Steam— | | | |
| Pump 1·95 tons at 80 c. | 1·56 | 0·078 | 0·039 |
| Blower 1·20 tons at 80 c. | 0·96 | 0·048 | 0·024 |
| Repairs and Maintenance | 1·00 | 0·050 | 0·025 |
| Cost of liquid purification | 4·72 | 0·236 | 0·118 |
| Catch-box operation (estimated) | 3·00 | 0·15 | 0·075 |
| Total cost of purification | 7·72 | 0·386 | 0·193 |

* Assuming one penny is equivalent to two cents.

**Book Received.**—We have received from Sir Isaac Pitman and Sons, Ltd., Parker Street, Kingsway, W.C., a copy of "Incandescent Lighting," by Mr. S. I. Levy, B.A. (Cantab.), B.Sc. (Lond.), F.I.C., which will be noticed more fully in due course. This is another volume of Pitman's "Common Commodities and Industries" series.

## MOTORS FOR USE IN GAS-WORKS.

By G. E. MASON.

**[A Paper to be read on the occasion of the visit of the Manchester and District Junior Gas Association to the Works of the Lancashire Dynamo and Motor Company, Ltd., Dec. 6.]**

Before considering the special points for attention required in the manufacture of motors for use in gas-works, it would be perhaps as well to consider briefly the uses to which the motors are put, and enumerate some of the difficulties that have to be met.

Gas-works engineers generally prefer to instal their own generating plant, the generators being driven by gas-engines. A number of these generating sets have been installed in the purifier-house, and trouble has occurred through the sulphur that is present in the foul gas, and which has had a bad effect on the insulation. The manufacturer can protect the machines against this to some extent by the use of suitable varnish. But in all cases where it is practicable, the generating set should be installed in some other place; and it is often advisable that the engine-room be specially ventilated, in order to secure reasonably clean air for the ventilation of the generators. Exhaust fans should be installed in such a position as to draw the air around the engine away from the dynamo.

Electric motors are used principally on the coal and coke elevating and conveying plant, the coal breakers and coal crushers, retort-charging machines, wagon tippers, the fans for waste-heat boilers and for gas blowers; and a certain number of motors are used for pumping and in connection with the manufacture of bye-products. The motors driving the coal and coke handling plant are generally situated in exposed and dusty situations, and are frequently mounted on foundations which subject the motor to a considerable amount of vibration. The first essentials of motors for this duty are that they shall be sturdily built, entirely dust and dirt proof, while at the same time the interior should be easily accessible for inspection; otherwise this rather irksome duty is likely to be shirked or carried out inefficiently. The motors on retort-charging machines are also subjected to severe mechanical conditions and considerable heat from the retorts. Motors for driving the fans and pumps about the gas-works are generally placed in rather better surroundings, and their duties are not so severe.

It might perhaps not be out of place to mention that there is no reason why alternating current motors should not be used for gas-works duties, if the town supply is alternating and a stand-by source of supply is desired. The simplicity of the alternating current motor, and, in particular, of the "squirrel-cage" motor, renders it specially suitable for the arduous duties of a gas-works plant. Any difficulties which arise from the comparatively poor starting torque of squirrel-cage motors are entirely eliminated by the use of the Lancashire slip clutch pulley. There are now many installations of coal conveyors, coal breakers, and coke crushers, &c., which are driven by squirrel-cage motors and Lancashire slip clutch pulleys, with most satisfactory results. If this combination is used, the troubles which many gas engineers regard as inevitable with electric motors installed in gas-works entirely disappear.

Before leaving the subject of the conditions under which motors are expected to function satisfactorily, the writer might add that he was recently told the following by the electrical engineer of a very large cement mill: A new electrician had been sent along an elevator tunnel to inspect a motor, and returned with the report that he could find no motor in the tunnel. Investigation showed that the motor was completely buried in a pile of cement, which covered both it and its gearing, which in this case was boxed in.

Turning now to the manufacture of the motors themselves, we cannot do better than follow the progress of one through the shops, pointing out the essential features required in order to ensure reliability in the completed motor, and the degree of accuracy necessary in order to provide interchangeability of parts or whole motors in cases of breakdown. A reliable electric motor is not entirely a matter of mechanical accuracy of machined parts; and it is one of the difficulties that the manufacturer has continually to contend with, that errors of carelessness on the part of individual workmen can be so easily concealed, and cannot be detected by any system of inspection except that of continuous inspection during the process of manufacture, and the continual insistence to the workman that his work must be right. "It's all the same when it's got a coat of varnish on" is at once what keeps the shoddy manufacturer in business, and the bane of the conscientious manufacturer.

The first processes seen on entering the works are the machining of the various mechanical parts. While these operations are of interest to all engineers, they have no special interest to gas-works engineers, except that emphasis should be laid on the importance of accurate machining to fine limits, in order to secure interchangeability of parts and satisfactory running. All the mechanical parts are sent in to a central stores, from which they are handed out to meet the various selling orders; and a glance through these stores will show the very large variety of parts which have to be carried in stock in order to meet the requirements of a standard line of A.C. and D.C. motors.

In the press shop, where the armature and stator and rotor

plates are blanked and notched, it may be noted that each is ground to remove any roughness, and in order to secure low iron losses. Adjacent to this shop is the core-building shop, where the armature and rotor plates are assembled on their spiders, and the stator plates assembled in their frames. It is in this shop that you can note the first point of importance to gas engineers. The current practice of most manufacturers is to assemble the armature plates direct on the shaft, so that in case of a damaged shaft, the whole armature has to be replaced, unless electric welding is resorted to. In the "Lancashire" manufactures the armature plates are built up on a spider, on which is also mounted the commutator, and into which the shaft is pressed; and if the shaft is damaged, it can equally well be pressed out, and an entirely new shaft fitted in.

The next shop of interest is the winding shop; and here the greatest care is required in order to secure an entirely reliable motor. An examination of the operations carried on in the winding shop will make you realize the great importance of the most careful workmanship. It is in this shop that one has to depend more on the continual insistence to the workmen that nothing but the best work will be permitted, than on any mechanical check on the work after it is completed. It is quite possible for scamped work to pass the test bed, as it is only time and service conditions which will cause this scamped work to show up. While observing what checks we can, we attribute our reputation for building reliable motors very largely to the continual insistence to our workmen that every job must have thoroughly good work put into it.

The exceptional amount of mica insulation inserted into the armature and stator slots is worthy of note, and the manner in which each piece of slot insulation is carried out well beyond the end of the slot—both very important points when considering the eventual life of the motor. On the alternating current motors the methods adopted of winding two or three stator coils with one continuous length of wire, and of avoiding joints on rotor coils, should be noted, as soldered joints are a frequent cause of breakdown in all motors. The intense heat used to join the rotor bars of squirrel-cage motors to their end rings should also be observed; the consequent joint being so secure that it is an impossibility for it to become insecure under any heat to which a motor could be subjected. The squirrel-cage rotor so produced is, of course, without insulation, and is practically indestructible.

The most important part of this shop, however, from the view of the customer who is seeking a reliable motor to work under severe conditions, is the impregnating plant, through which every wound article passes before proceeding to the assembly shop. The thorough impregnation of every winding, and the ultimate coating of that winding with a smooth varnish, is one of the most important points to be observed in connection with motors for gas-works duties, as the powers of resistance of the windings to moisture and gas are very largely dependent on their thorough impregnation.

Particular attention should be paid to the benches on which the completed armatures lie, in order to observe the special treatment of the end windings and commutators, to make them resist the gas-laden atmosphere. While duly noting the care taken in this respect, the gas engineer should bear in mind that acid fumes and gases, particularly those containing sulphur, are extremely harmful to insulation. While the manufacturer does what he can, the engineer should protect his electrical machinery as much as possible from these influences.

In the fitting shop will be found all classes of machines undergoing assembly; and the special dustproof fittings required for gas-works motors will be noted. The alternating current machine is much easier to make totally enclosed than the direct current machine, as there is not the same necessity for internal inspection; in fact, when ball and roller bearings are used, as in the case of all our alternating current machines, the necessity for internal inspection or of any inspection at all, except at long intervals, is practically eliminated. In the case of direct current motors the greatest care has to be exercised that the fittings of the doors at the commutator end are dust and dirt proof; and to this end the substantial thumb-screws fitted to these doors, as well as to the oil-well covers, should be noted. While the motor is thoroughly dustproof, the design of the door is such that when open the interior of the motor is very accessible.

The use of ball and roller bearings on direct current machines is becoming more common. While we have supplied many hundred machines with oil-lubricated bearings which have proved dust and dirt proof, it is advantageous, both from the manufacturers' and the customer's point of view, to fit ball and roller bearings to both A.C. and D.C. motors when dirt is likely to be a serious factor.

In the fitting shop can also be seen the assembling of the "Lancashire" slip clutch pulleys, to which earlier reference has been made. After assembly the motors are delivered to the test bed; and here one gets a general idea of the many types required to fill the needs of various customers. After testing, the motor passes to the inspecting, painting, and finishing department. In this department the motor is carefully checked against the customer's requirements, all loose parts collected together, and prepared for dispatch. As a check upon the efficiency of the various works departments, the inspection department is made responsible only to the Works Manager, and it is part of their duty to report to him any workmanship or other matter which they consider is not entirely first-class.

## ILLUMINATING ENGINEERING.

At the meeting of the Illuminating Engineering Society last Tuesday, the Hon. Secretary (Mr. L. Gaster) gave an account of the progress during the vacation.

In the first place, Mr. Gaster said it was gratifying to record that Sir John H. Parsons had kindly consented to continue in office as President during the present session. He also recalled that at the annual meeting three additions were made to the Council—viz., Dr. J. F. Crowley, Mr. Phillip Sugg, and Mr. D. R. Wilson. He also stated that in the report of the Council for the past session, reference was made to the urgent need for great support and increased membership, in order that the Society might extend its activities and realize, on a greater scale, the objects for which it was created. A sub-committee of the Society had accordingly been formed to consider means of propaganda and methods of increasing the membership and influence of the Society. He referred to the issue of the third report of the Home Office Departmental Committee on Lighting in Factories and Workshops as an event of outstanding importance. This report, after summarizing recommendations contained in previous ones on the subject of glare, avoidance of shadows, &c., pointed out that further research was necessary before legal standards for working illumination could be framed. This matter, it was suggested, should be studied in co-operation with the chief industries concerned; but meanwhile minimum values illustrative of good practice were recommended for fine work (requiring 3 foot-candles) and very fine work (requiring 5 foot-candles). The original scheme of work of the Committee had been curtailed by the urgent demands in the interests of national economy; and it was, therefore, of importance that the aims of the Committee should be made familiar, both to the lighting industry and to managers of factories, and their aims fully understood. It was hoped to arrange for several papers before leading scientific societies and trade associations, with the object of making these aims widely known.

After alluding to the report of the Miners' Nystagmus Committee, issued by the Medical Research Council, Mr. Gaster said that the subject of street lighting had been receiving attention—several new schemes having been recently introduced in Oxford Street and elsewhere in London; while in some provincial cities substantial economies, coupled with improvements in illumination, had been effected by the substitution of the latest superheated inverted gas-burners for those of an obsolete type. Street lighting as a factor in "street safety" had also been receiving attention from the London "Safety First" Council, with whom the Society continued to co-operate. Statistics published in the United States led to the conclusion that 17·6 p.ct. of street-accidents occurring at night were due to inadequate lighting. In view of the importance of the subject, arrangements had been made for a discussion on street lighting to take place at a meeting of the Society on Dec. 12, in which the Institutions of Gas and Electrical Engineers, the Institution of Municipal and County Engineers, and other bodies interested had been invited to co-operate. The British Industrial "Safety First" Association had recently devoted special attention to the analysis of accidents in factories, reference to which was made in the "Safety First Journal." Special mention was made by Mr. Gaster of the Eleventh Annual Conference of the British Commercial Gas Association in Bristol during October, when a number of papers illustrating the applications of gas in the public service were presented. Of these, special interest attached to that by Mr. Robert Watson on "Modern Gas Lighting, with Special Reference to the Illumination of Factories and Workshops." Other matters were referred to; but they have less interest for our readers.

In connection with this report, Mr. W. J. Liberty showed some very interesting night photos which he had taken of the special rooms at the new headquarters building of the Port of London Authority on Tower Hill, including the Chairman's (Lord Devonport's) rooms, the members' lunch room, the members' lounge, and the large rotunda to be used by the Port rates clerks. It will be remembered that the building was opened by the ex-Premier just previous to his going out of office—the photos being taken the night before. Mr. Liberty stated that he thought the members would agree that the views were charming pictures, considering the rather dark surrounds in oak and walnut and the long exposure therefore necessary, and also that they were taken at about 8 p.m., with no light beyond that shown in the photos. The interior of the large central building, he considered, came out extremely well from a lighting point of view, being almost shadowless; while the lighting of the special rooms was without exception especially good. The working plane—*i.e.*, tops of tables and chairs—and even the floor line, was well illuminated, while the upper decorative portion came out well in light and shade. A very pretty interior photo of the Dulwich Village night and winter hard tennis courts was thrown on the screen by Mr. Liberty. The courts are beautifully lighted by high-pressure gas by the South Metropolitan Gas Company. The lighting, as shown, is perfect from a player's point of view, the ground lines being absolutely shadowless. Mr. Liberty gave this interior view of these famous tennis courts as a specimen of the buildings that members of the architectural profession might be called upon to erect or design.

# CORRESPONDENCE.

*[We are not responsible for opinions expressed by Correspondents.]*

## Low-Temperature Carbonization and the Therm.

SIR,—I have looked through Mr. Chaney's notes on p. 492 of your issue of the 22nd inst., which, in my opinion, do not meet in any shape or form the criticism directed to Mr. Chaney's original figures.

In Mr. Chaney's reply, the following words occur; "The writer should preface his remarks by stating that neither the method of arriving at the cost of the therm nor the apparent double credit for the coal has been overlooked." I think this makes Mr. Chaney's position worse than ever. It is tantamount to saying that he knew his method of calculation was wrong. He deliberately put in a saving of £3979 per annum for a small company, when £1100 should have been the correct figure; and I should like you to note that this £1100 accepts every figure which Mr. Chaney introduced into his original article. If a school boy were to state that 6 *plus* 6 was equal to 40, and after being told it was only equal to 12, made the remark that the matter "had not been overlooked," what should we think of his arithmetical training?

I will only deal with one further point. Mr. Chaney infers that his figures of 8d. per therm for coal gas and 4d. per therm for water gas were correct, and therefore any hypothetical figures which I worked out must necessarily be wrong. I repeat, however, that it is impossible to produce coal gas at 8d. and water gas at 4d. in the circumstances which Mr. Chaney outlined, and accepting his prices for coal and coke and production of each gas per ton of coal or coke carbonized.

If Mr. Chaney's cost of production worked out at approximately the figures given, then the allocation of cost was absolutely wrong. In other words, the coal gas had been saddled with costs unduly, and the water gas was not debited with the proper cost of production into the holder.

Thirty-five shilling coke at 156 therms per ton will cost 2·69d. per therm for coke only; and it is impossible, on the small scale mentioned by Mr. Chaney, to provide wages, salaries, purification, repairs to water-gas plant, and repairs to the remaining part of the works, for the sum of 1·31d. per therm.

It is quite obvious that, if a percentage of a certain gas is taken at 8d. and a percentage of something less than 8d. is mixed with it, the overall cost *must* work out at less than 8d., and therefore there is an apparent saving. In Mr. Chaney's revised table appearing in last week's article, I notice he still adheres to coal gas at 8d., which, as above stated, is not comparable in any works with water gas at 4d. or 5·7d., taking the costs of coal and coke as given by Mr. Chaney. Therefore, in continuing to calculate coal gas at an extremely high price, Mr. Chaney can show a saving for the admixture. If he were to take coal gas at 10d. he could show a still further saving.

Mr. Chaney's saving in his first table in the article of Nov. 22 amounts to £3080, with low-temperature gas at 6d. This hardly squares with a saving of £3979 with the same low-temperature gas at 9d.; and this is conclusive proof that the original basis of the saving was wrong.

I notice he still refers to the saving in the original article (with water gas at 4d. per therm) as £3979. Why does Mr. Chaney still repeat an error which in the preface of his remarks he states has not been overlooked?

GEO. EVETTS.

*Palace Chambers, Bridge Street, S.W.,*
*Nov. 24, 1922.*

## Do We Know Where We Are?

SIR,—I congratulate Mr. Glover on hitting the nail on the head first shot in his letter of Nov. 16. It is the cost of conversion of the coke into cash which gives trouble. When a gas-works engineer can get £12 10s. a ton for his coke, as I believe was the case with some works within quite recent times, I quite agree that the production of coke at the present time is profitable. On the other hand, I am informed that coke is being sent from London to the Provinces and delivered at 24s. a ton.

My idea, as an engineer who tries to study the interest of the consumer, as well as that of the gas industry, is that in the majority of cases coke is an infernal nuisance from the time it leaves the retort until it is absorbed either in some subsidiary process, such as the manufacture of water gas, or on the local market. There is no doubt that the introduction of water gas prolonged the life of the old-fashioned system of gas making in horizontal retorts, which had held the field practically undisturbed for nearly a century. There are, however, very serious forces operating which confirm me in my opinion that, however satisfactory the old system was, its inherent defects will inevitably lead to the adoption, in the national interests, of improved and essentially more efficient methods for the production of gaseous or solid fuel for domestic or industrial use in the future. I refer particularly to the increasing cost of coal in this country, due partly to the lower levels at which it has to be won, the increased operating costs which many of us are experiencing, and the development of foreign coalfields where coal can be won more cheaply than in this country. Reduced transport and freight charges may intervene to keep the cost of coal down; but I am one of those who believe in the development of our home resources to the utmost. In the past, owing largely to our cheap coal, we were a specially favoured nation, and could compete favourably in foreign markets; but circumstances have changed, and it is essential that we should get the utmost out of our coal. As Mr. Glover is no doubt aware, I believe in the complete gasification of coal, if not as a cure-all, at any rate, as a very practical means of meeting many of the difficulties which face most gas engineers—namely, to supply a gas which is capable of being used efficiently by the consumer while yielding a reasonable profit to the undertaking, in the face of increased cost of raw material and increased operating costs.

A large number of British gas engineers put down complete gasification plant during the past few years. This is not so important as the fact that many sent repeat orders. Not only in this country, but abroad, has this occurred. The development was far more rapid than I should have wished, as I should have preferred to feel my way more carefully from several points of view; but there are numbers of manufacturers of all kinds in this country who will say the same, as a result of their experience of the last three years. I have been told repeatedly that the plant which bears my name has saved the situation on several occasions, and has been a source of considerable profit. I do not claim that the plant has reached perfection, but I am satisfied that we are on the right lines; and I have the support of distinguished gas engineers both in this country and abroad. Those engineers who find it profitable to make coke—and there are sound reasons for doing so—are thoroughly justified; but where it is a case of installing new plant or replacing worn-out plant, the factors of capital cost, working and operating costs, &c., come in. Apart from this, there is the question which has been a source of anxiety and complexity to many gas engineers—*i.e.*, what value to declare. I am in favour of a 350 to 400 B.Th.U. gas; but circumstances alter cases, and provided the gas is low in inerts a 350 B.Th.U. gas, or even less, is proving quite satisfactory for domestic use. Increase the consumption of gas to the utmost. This is by far the best method of effecting economies and reducing costs. As this will tend to still further increase the ratio between the amount of gas and coke consumed, it stands to reason that methods for efficiently gasifying coal will be more and more applied in the future.

C. B. TULLY.

47, *Victoria Street, London, S.W.* 1,
*Nov.* 28, 1922.

## Mr. Poulson's Midland Association Paper.

SIR,—I notice that your account of the meeting of the Midland Association of Gas Engineers reports me incorrectly. In speaking on Mr. Poulson's paper, I am made to say: "In regard to casual labour, much economy was effected." What I did say, or meant to say, was: "In regard to clerical labour, much economy was effected."

*Gas-Works, Cheltenham, Nov.* 25, 1922. J. PATERSON.

## Subjects for the Therm Inquiry.

SIR,—You have dealt at considerable length in various editorials with points which it would *not* be profitable to inquire into in the event of the Board of Trade holding an investigation into the "therm" method of charging under the Gas Regulation Act. May I suggest one or two matters which might very profitably be discussed?

1.—How many competent gas examiners have been appointed in proportion to the number of undertakings coming under the Act?

2.—How many recording calorimeters have been installed, which are made *compulsory* by the Act for undertakings selling more than 100 million c.ft. of gas?

The above matters relate to the safeguards to the consumer, which are absolutely vital for the fair working of the Act.

3.—Why charge by the therm when gas is measured by the cubic foot, which is precisely equivalent to buying a pint of gooseberries at so much per pound?

ARTHUR CUNNINGTON.

26, *Muncaster Road,*
*Clapham Common, S.W.,*
*Nov.* 27, 1922.

## The Limitations of the Law of Inverse Squares.

SIR,—In reading through my article on "The Limitations of the Law of Inverse Squares, as applied to Photometry," as published in your last issue, I noticed an error. Lines 9 and 10, col. 2, p. 494, read: ". . . intensity of illumination being inversely proportional to $A_1D$." This should, of course, have read ". . . inversely proportional to $A_1D_2$." The slip is rather an obvious one; but you may think it worth while publishing a correction.

A. R. MYHILL.

1, *Daniels Rd., Little Bromwich, Birmingham,*
*Nov.* 25, 1922.

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**Dalmellington Gas-Works for Sale.**—The Dalmellington Gas-Works are for sale by public auction. The output is 1¼ million c.ft. annually, and the rate 10s. per 1000 c.ft. The upset price has been fixed at £300.

**Stirling and the Therm Basis.**—The Stirling Town Council, on a recommendation of the Lighting Committee, have resolved to approach the Board of Trade, in view of the numerous complaints, not only in Stirling, but elsewhere, with a request to reconsider the basis upon which the standard price per therm has been fixed, as corresponding to that previously in force per 1000 c.ft., in terms of the Gas Regulation Act, 1920.

**Gas Fatality at Batley.**—An inquest has been held at Batley on the body of Elsie Wilson, aged 14, a servant girl, who was found dead on her bed. Death was apparently due to gas poisoning as the result of an escape from a bracket in the room. The Coroner said he was satisfied that the girl, after using the gas, had failed to turn-off the tap properly. He would return a verdict of "Death from accidental gas poisoning." The gas being used to-day contained carbon monoxide, which was dangerous even in small quantities. It was worth while calling public attention to the matter, and urging special care in the turning-off of taps. Mr. R. H. Duxbury (the Gas Manager), in an interview, pointed out that the gas from the vertical retorts contains 13 p.ct. of carbon monoxide, as against 7 p.ct. in pre-war days. If the water-gas plant, at present out of commission, were used, the percentage would be slightly increased. The point to be remembered is that all coal gas contains a percentage of carbon monoxide.

# PARLIAMENTARY INTELLIGENCE.

## NOTICES GIVEN FOR BILLS (SESSION 1923) RELATING TO GAS SUPPLY.

Notices have so far been published of the following Bills which it is intended to promote, in connection with gas undertakings, in the 1923 session of Parliament.

**Barnsley Corporation.**—A Various Purposes Bill of the Barnsley Corporation will include provisions for the purchase by the Corporation by agreement or compulsion, and giving power to the Barnsley Gas Company to sell the undertaking of the Company to the Corporation; the application of purchase money; and transfer or compensation of officers and servants.

**Birkenhead Corporation.**—A Bill to be introduced by the Corporation will include clauses for the conferring of further powers upon them in connection with their gas undertaking, including the laying of mains and other works throughout their limits of supply; and to define the limits for the supply of gas and water by the Corporation and the Hoylake and West Kirby Gas and Water Company, Ltd., in the parish of Bidston, throughout which they now have concurrent powers.

**Chesterfield Corporation.**—In an Omnibus Bill, the Corporation will ask for further powers in connection with the carrying-on of their gas undertaking.

**Hoylake and West Kirby Gas and Water Company, Ltd.**—A Bill is to be promoted for the dissolution of the Limited Company and the incorporation of a new Company for supplying gas and water within limits defined; for the regulation of capital; for the conferring of various powers incident to the manufacture and supply of gas and residuals; for the increase of gas rents and charges: and for authorizing special provisions relating to the supply of gas to caravans, shacks, wooden huts, and like structures. There will also be clauses for the confirmation of, or giving effect to, a district agreement of 1915 between the Limited Company and the Birkenhead Corporation, and the repeal of powers of that Corporation to supply gas and water in the parish of Bidston-cum-Ford.

**Macclesfield Corporation.**—Notice is given by the Corporation of their intention to bring in a General Powers Bill, the objects of which will include the making of fresh provisions with regard to public lighting, and the conferring of further powers upon the Corporation in connection with their gas undertaking, including the construction of additional works on existing gas lands, and the application of gas revenue.

**Oakham Gas and Electricity.**—The Oakham Gas Company, Ltd., will apply for an Act to enable them to supply electricity in their present gas limits; to erect a generating station and works on existing gas lands; to make conditions as to, and limitations on, the purchase by the Local Authority of the gas and electricity undertakings; to regulate the supply of gas; to raise additional capital; and to change the name of the Company.

**Plymouth Corporation.**—Among other things, the Corporation will ask in a Bill to have conferred upon them further powers in regard to the conduct of their gas undertaking and the supply of gas.

**Rawmarsh Urban District Council.**—The Council will seek such further powers as are usually conferred in connection with their gas undertaking, and also authority to increase the charges for gas supplied by them and to vary the method of charge.

**South Elmsall and District Gas.**—This is a Bill for the incorporation of a Company for the supply of gas in South Elmsall, North Elmsall, and a number of other parishes and townships in the West Riding. It is sought to vest in the Company the gas undertaking authorized by the South Elmsall, South Kirkby, and North Elmsall Gas Order, 1900. Various powers will be included incidental to the manufacture and supply of gas.

**South Oxfordshire Water and Gas Company.**—It is the intention of the Company to apply for leave to bring in a Bill to permit of the consolidation, conversion, and reduction of the nominal amount of the existing water capital and gas capital; the alteration of amounts of further share and loan capital; and the exchange of bonds, debentures, and other securities for ordinary or preference stocks or other securities. Provisions will be included in the matters of dividends, interest, and sliding-scale; terms and conditions affecting the holding of share and loan capital; meetings of the Company; and pensions and allowances.

**South Staffordshire Mond Gas Company.**—Notice is given by the South Staffordshire Mond Gas (Power and Heating) Company of their intention to apply for a Bill to authorize them to change the name of the Company, and to authorize them to supply their gas to undertakers supplying gas in or adjacent to the Company's district of supply, and others. They will seek the repeal or amendment of any provisions of their Act of 1901, restricting the use of such gas, whether for illuminating or other purposes, or in dwelling-houses, or the amount of carbon monoxide which may be contained therein, &c. The Company desire further borrowing powers, and also additional powers for the recovery of rents and moneys due to them.

**Swanage Gas and Electricity.**—Application is intended to be made in a Bill by the Swanage Gas Company for power to transfer to the Company the undertaking of the Swanage Electricity Supply Company, Ltd.; to erect a generating station and gas-works upon land in the parish of Swanage on part of which the Company's gas-works have been constructed; to extend the limits for the supply of gas and electricity so as to comprise the urban district of Swanage and the parishes of Langton Matravers and Studland; and to make further provisions in regard to the gas undertaking and the supply of gas, additional capital, change of name, co-partnership, and other matters.

**Torquay Corporation.**—Among various things the Corporation will seek, in a Bill to be introduced by them, further powers and provisions with regard to their gas undertaking and the supply of gas and provision of fittings.

# LEGAL INTELLIGENCE.

## GAS-STOVE LITIGATION.

On Friday last, application was made to Mr. JUSTICE ROMER, in the Chancery Division, in the case of *The Richmond Gas Stove and Meter Co., Ltd., and John Wright and Eagle Range, Ltd., v. Stoves, Limited*, for an injunction to restrain alleged infringement of a number of registered designs of gas-stoves.

Mr. DRAPER, who appeared for defendants, asked for an adjournment in order that he might answer the evidence, offering to keep an account of the stoves sold in the meanwhile.

Sir DUNCAN KERBY, K.C., for the plaintiffs, objected to any adjournment, and said he was prepared to move *ex parte* as time was of importance. This was the busiest season of the gas-stove trade, which was now in full swing. It was at this important time that defendants had put on the market infringing stoves at cheaper prices; and irreparable damage would be done to plaintiffs if it were allowed to go on. The plaintiffs took the view that nothing but an undertaking not to sell, or offer for sale, the stoves complained of pending the hearing of the action would meet the case. There were two complete stoves covering the whole thing; but, in addition, each stove was made of a number of parts which were the subject of registration. Defendants were a newly-formed Company consisting of a number of persons who had been in the employment of plaintiffs and knew all about their business; and they had put on the market two stoves which were extraordinarily close imitations of the plaintiffs' "Marlborough" and "Midget." The resemblance was so close that it was suggested the defendants had actually used parts of plaintiffs' stoves with which to mould theirs. Certain alterations had been made in order to escape trouble in the Courts; but the case of the plaintiffs was that there had been an obvious and fraudulent imitation.

His LORDSHIP, after inspecting the different exhibits, said that *prima facie* it seemed a very serious case of imitation, and granted an *ex parte* injunction for a fortnight.

# REGISTER OF PATENTS.

## APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Nov. 22.]

Nos. 30,928 to 31,616.

APPLEBY, E. G.—"Gas-producers, retorts, &c." No. 31,122.
BASTIAN-MORLEY COMPANY.—"Gas-regulating valves." No. 31,035.
BASTIAN-MORLEY COMPANY.—"Water-heaters." No. 31,036.
BENTLEY, G. H.—See Appleby, E. G. No. 31,122.
CLAPHAM, T. A.—"Valve-mechanism for apparatus for purification of gases." No. 31,408.
GARBARINI, A.—"Gas-heating radiators." No. 31,496.
GAS LIGHT AND COKE COMPANY.—"Manufacture of sulphurized dyes." No. 31,595.
GAS LIGHT AND COKE COMPANY.—"Conduct of chemical reactions involving use of gases, &c., under pressure." No. 31,596.
GAS LIGHT AND COKE COMPANY.—"Crystallization." No. 31,597.
HARPER, N. C. T.—"Retorts or stills." Nos. 31,156, 31,157.
HARRIS, H. W.—"Apparatus for controlling lighting and extinguishing of gas, &c." Nos. 31,386, 31,485.
HELPS, G.—"Gas-burners." No. 31,272.
LEVY, L. A.—"Gas analysis." No. 31,235.
MORGAN, J. S.—"Method of distillation." No. 31,012.
RENDLE, A. J.—"Appliance for repairing vertical gas-retorts, &c." No. 31,123.
SHANNON, W. V.—See Gas Light and Coke Company. Nos. 31,596, 31,597.
SIDERFIN, N. E.—See Gas Light and Coke Company. Nos. 31,596, 31,597.
SIMMANCE, J. F.—See Levy, L. A. No. 31,235.
SIMMANCE, J. F.—"Indicating or recording apparatus for gas analysis. No. 31,450.
SOUTH METROPOLITAN GAS COMPANY.—See Harris, H. W. Nos. 31,386, 31,485.
THERMAL INDUSTRIAL AND CHEMICAL (T.I.C.) RESEARCH COMPANY, LTD.—See Morgan, J. S. No. 31,012.
WILLIAMS, R. A.—"Apparatus for discharging coke from gas-retorts." No. 31,426.
WITHERS, J. S.—See Bastian-Morley Company. Nos. 31,035, 31,036.
WOLLASTON, T. R.—"Apparatus for measuring flow of gases, &c." No. 31,195.
WOOD, F.—See Simmance, J. F. No. 31,450.

**Colonial Gas Association, Ltd.**—At the annual meeting next Tuesday, the Directors will report an increase in the gas sales for the year ended June 30 of 8·46 p.ct. The accounts show that, after deducting £2998 for depreciation, and adding £6446 brought forward from last year, the amount available for final dividend on the preference shares and for dividend on the ordinary shares for the year is £22,539. The preference dividend (less tax) to June 30 has been duly paid; and the Directors recommend payment of a dividend on the ordinary shares of 9 p.ct. (less tax), adding £2000 to the reserve fund, and carrying forward £6952. It will be necessary in the near future to raise further capital to provide additional works and plant. It is accordingly proposed to increase the share capital from £250,000 to £350,000. It is with much regret that the Directors report the death of their esteemed colleague Mr. Samuel E. Figgis. Mr. Figgis had been a Director of the Association for 8½ years, and was for 4½ years Managing Director, during the whole of which time he rendered very able services to the Association.

# MISCELLANEOUS NEWS.

## THE ECONOMY OF SMOKE ABATEMENT.

Lord NEWTON, who was Chairman of the Departmental Committee on Smoke Abatement, presided at a meeting of the Royal Society of Arts on Wednesday last, when ex-Bailie W. B. SMITH, of Glasgow, who was a member of the Departmental Committee, read a paper in which he dealt in great detail with smoke abatement.

The CHAIRMAN, in opening the meeting, made some caustic remarks on the manner in which the Daily Press ignored this subject in general and the Committee's report in particular, and spoke generally upon the causes of the smoke nuisance. Those who had been most active in this matter, he said, had done their best amid the most discouraging circumstances.

Ex-Bailie SMITH, who illustrated his paper with a large number of lantern slides from photographs of some of our large towns under conditions of smoke clouds, and also photographs taken when the industrial works were not in operation, traversed the details of the Smoke Abatement Committee's report, and said that the time had come when the problem should be tackled by the public themselves. In regard to what the Committee had said concerning the use of gas, he recommended, in the case of new houses, where gas was available at reasonable cost, the installation in each house of one of the new-type boilers burning coke, capable of being used as a closed or open fire at will, to warm the living room and to supply the hot water required for all purposes; the use of a coke-fired boiler being the cheapest method of heating water. A wash-boiler should be fitted in the scullery, set through the wall and back-to-back with the coke-boiler, supplied with hot water from this boiler, and with a gas-burner under it to raise the hot water up to boiling point when required. In the scullery there should also be a gas-cooker, provided with a canopy and pipe into the boiler flue to carry off all products of combustion. The flue from the wash-boiler would also go into the flue from the coke-boiler. In each bedroom there should be a gas-fire, with a flue of long narrow section in the special bricks forming part of the wall. These bricks might also contain a second ventilating flue. In this way money would be saved in construction. The lighting would be done by gas.

Discussing the attitude of the Ministry of Health on this matter in connection with the erection of new dwelling houses, the author said he could not find that any action had been taken by the Ministry to enforce, or even to suggest, any smokeless method whatever in the plans submitted to them for approval. They seemed to have passed and approved of plans showing the old-fashioned smoky fireplaces, although all the smokeless methods actually cost less money in construction. In recommending the Ministry to take action now on all new houses, they were only anticipating the adoption of smokeless methods on which the people themselves were beginning to insist.

As to the necessity for offering smokeless fuels which would appeal to householders, the author said that if a smokeless fuel which was better than raw coal were put on the market, it would immediately prevent smoke from the fireplaces as they are at present. While working in this direction, he had come upon a solution of the problem of pollution not only from domestic, but also from industrial chimneys. In 1910, addressing a meeting of gas engineers, he had predicted a greatly increased demand for gas for domestic use, and had said that they would have to find a process of making gas that would produce, at the same time, a coke that could be used as a smokeless fuel, instead of coal, under all conditions. From that time he had inquired into every process he had heard of that might fulfil the conditions; and the Maclaurin process of low-temperature carbonization seemed to him to meet both demands—a good smokeless fuel and cheap gas. There had been a great deal of conflicting evidence before the Committee from manufacturers. Some had said that they could not carry-on without emitting smoke, while others had proved that smokeless methods were possible and were better in every way. There was a great deal of difference of opinion among potters, some of whom said that it was not possible to fire certain classes of china except by raw coal; but the Committee had visited Stoke-on-Trent and had seen several potteries where gas firing was carried out successfully, the gas saving about 70 p.ct. of the cost of fuel. Since then he had seen at work a gas firing system invented by Mr. J. H. Marlow, of Messrs. Minton, Hollins & Co., Stoke-on-Trent, where, with producer gas made from 21 tons of coke, the same amount of work was done that under the old system would have cost them 90 tons of coal. Not only was there the saving of 69 tons of fuel, but the price of the coke to-day is only 20s. per ton, with coal at 35s. per ton; and there was a saving in cost of labour of fully 33⅓ p.ct.

Leading up to the possibilities of low-temperature carbonization, the author calculated the costs of one therm of heat actually utilized (taking the therms in an average ton of coal as 267), assuming certain reasonable efficiencies and probable costs for gas and coal under different conditions, in the following table:

| — | Efficiency taken for Coal. | Efficiency taken for Gas. | Cost per Therm Utilized. | | | |
|---|---|---|---|---|---|---|
| | | | With Coal at 40s. | With Gas at 9d. per Therm. | With Coal at 20s. | With Gas at 3d. per Therm. |
| | P.Ct. | P.Ct. | d. | d. | d. | d. |
| Cooking . . . . | 10 | 50 | 18 | 18 | 9 | 6 |
| Heating. . . . . | 25 | 60 | 7·2 | 15 | 3·6 | 5 |
| Steam raising . . . | 70 | 70 | 2 57 | 12·8 | 1·28 | 4·3 |
| High-temp. operations | 15 | 70 | 12 | 12·8 | 6 | 4·3 |

With gas at 9d. and coal at 40s., therefore, gas would be as cheap as coal for cooking operations. It was evident from the table that for gas-fires gas had to rely for its economy on its convenience and indirect saving of labour, and use only when actually required; that gas was hopeless for steam raising and water heating in bulk, but for high-temperature operations it could be utilized. With coal at 20s. per ton and gas at 3d. per therm, cooking and high-temperature operations would be cheaper with gas. Domestic heating for long periods would appear to be rather dearer; but in practice it would actually be cheaper. Steam raising would be out of consideration for large installations with efficient management and constant load and good boilers. Before gas could hope to displace coal for steam raising, the cost would require to come considerably under 3d. per therm. The balance of economy in favour of gas was so slight at the present time that no great impetus was given to its more general adoption, although, no doubt, it was steadily but slowly gaining ground. But if the cost of the gaseous therm could be reduced to one-third or one-quarter of the present price, the balance would swing so strongly in favour of gas as to make its development extremely rapid. An efficiency of 70 p.ct. for gas firing could be safely assumed. Efficiencies of 88 to 92 p.ct. were possible with specially-constructed gas-fired boilers, such as the Bonecourt boilers. At 70 p.ct. efficiency, to obtain steam at the same cost as from coal, gas would require to be produced at the gas-works at 1·03d. per therm.

In support of his argument that it was to those industries in which gas was used for power, or for high-temperature operations, that gas would first make the strongest appeal, the author made calculations by which he showed that gas could be produced and distributed for the production of power by means of gas-engines much more cheaply than an equal quantity of power could be obtained from raw coal or electricity. A supply of gas laid-on to industrial concerns now using coal for high-temperature operations would also lead to the abolition of smoke and to national economy. Continuing, he said that gas undertakings might now add a new department to their works that might in time become as important, and quite as remunerative, as their present trade—namely, that of supplying gas for heat and power to industries, and making smokeless fuel for all purposes. They would be able to deliver gas for power and heat to a manufacturer at less cost than he could obtain it from producers in his own works. Gas undertakings could do this by making an industrial gas and delivering it in special mains in industrial areas, and, at the same time, producing smokeless fuel, for which there is a great demand, and many new bye-products.

As to domestic supply, gas could be carried to a point outside the consumer's house at an inclusive cost of 1·2d. per therm; and he proceeded to calculate the cost of getting it inside the house. He did this on the assumption that it meant installing a separate meter (larger than the present one) and pipes of larger bore to the different fireplaces and cooking stoves. The result showed that gas could be supplied to replace coal at prices which all classes could afford. The objection to two sets of mains was, at first sight, formidable; but if gas had really to replace coal on a large scale, new mains were imperative in any case, and in most houses new pipes and new meters would be required. Eventually, the cheaper gas would be used for lighting also, and the present inadequate mains could then be scrapped or used as feeders. With the more extensive use of gas, however, the domestic outlet for smokeless fuel would diminish, and a field for the smokeless fuel would have to be found in industry. Therefore, a smokeless fuel must find its outlet in those industries beyond that radius, or for those uses in which pipe lines were impracticable.

### DISCUSSION.

Prof. H. E. ARMSTRONG, F.R.S., dealing with the general question of smoke abatement, said that he hoped the day would never come when the open grate was done away with. A coal fire was a thing of beauty and a joy for ever; and it would be necessary to find a substitute for it which would not spoil that beauty. The smoke nuisance would be done away with at no very distant date, but not by legislation. A smokeless fuel which would have that effect was not very far away. It seemed to him that the Smoke Abatement Committee in their report foreshadowed throwing the public into the hands of the gas companies; but with gas in its present condition of indecision, the gas industry did not know where it was, or where it was going to be five years hence. It was no use asking the public to adopt gas. Neither was it any use asking the public to adopt central heating, which was a most uncomfortable method. It was necessary to develop a smokeless fuel, therefore, which could be used in the English ventilating grate.

Prof. W. A. BONE questioned very much whether some of the solutions indicated in the report of the Committee were altogether practicable. This was a matter which involved both physiological and psychological considerations, and he had little doubt as to the unsuitability of central-heating systems and low-temperature radiators. They were chiefly limited, owing to the conditions in the country, to gas and solid fuel. The gas-fire had been brought to a high degree of perfection, both hygienically and from the point of view of radiant efficiency; and if gas could be supplied at a considerably cheaper price than it was, or seemed likely to be for some considerable time, then gas would provide a good practical solution for a great part of the trouble on the domestic side. The running of gas-fires for any long period, however, was almost prohibitive from the point of view of cost, in many cases. Therefore, for the solution of the greater part of the problem they must come back to the solid fire. The sooner a smokeless fuel could be manufactured and distributed at much the same price as coal, the better.

Mr. F. LLOYD, representing the Sheffield Chamber of Commerce, first entered a protest against one of the photographs showed by the author. Proceeding, he said that certain classes of steel could not be made without making smoke. There had been much money spent in dealing with the difficulty in Sheffield. Every large firm had its chemist, and the Sheffield University had a Fuel Research Department; but as things stood at present, for instance in the rolling of thin steel sheets, smoke could not be prevented.

Prof. BONE said he knew quite well that the Sheffield steel firms had their metallurgical chemists; but he meant that there should be a special fuel technologist attached to the staffs.

Mr. F. W. GOODENOUGH (Gas Light and Coke Company), after explaining the position with regard to the Sheffield photograph, said that, representing the gas industry, he would like to reply to Prof.

Armstrong, who appeared to think that the industry had captured the Departmental Committee on Smoke Abatement. It was, of course, easy for those who did not like the Committee's findings to question the impartiality of the Committee. As to whether sulphurous acids had any effect upon certain classes of stone, architects were satisfied that they had. He would like to point out, however, that, in the case of gas, something like 90 p.ct. of the sulphur which was present in the original coal had been extracted before the gas was sent out; so that the products of combustion from a gas-fire contained only a slight trace of sulphurous acid, and would not have any effect upon buildings which might be in the neighbourhood. In regard to smokeless fuel, his Company made a very serious attempt a few years ago to produce and market a smokeless fuel in competition with coke and coal. They found, however, they could not, with all the resources at their command, produce a solid smokeless fuel at a price which would tempt the public to buy it in competition with smoke-producing fuel; and the manufacture had to be abandoned, because it was not commercially possible to supply. Prof. Armstrong had also said that the gas companies did not know where they are, and that they were not where they had been. It was quite true they were not where they had been, because they were going ahead. During the last three years the increase in gas appliances in the districts of his Company was 100,000, of which 50,000 had been fitted in the past twelve months, and the increase in that year was equal to that of the previous two years combined. This confirmed the view that the gas companies were not where they were. In fact, they were rapidly helping to solve the problem of smoke abatement in London and in other parts of the country. In his paper, the author had given a figure of efficiency for heating by solid fuel of 25 p.ct. This was rather misleading, if other considerations were not borne in mind. It was quite true that a coal-fire might give 25 p.ct. of its heat to a room during the hours it was burning, if it were properly stoked; but a coal-fire was burning for many hours when the heat was not required, and the true efficiency should be the total amount of heat given off in relation to that actually required, This would bring the comparison of cost between coal and gas very much nearer together than the figures in the paper.

Lord NEWTON briefly referred to some of the remarks made in the discussion.

## MESSRS. JOHN WRIGHT & CO.'S NEW SHOWROOM.

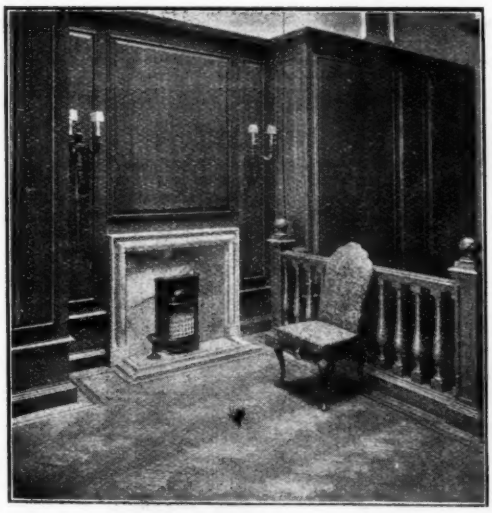
It has long been an article of faith with Messrs. John Wright & Co. that the future of gas-stove progress—particularly as regards gas-grates—lies in a large measure with the architectural profession. Regularly, during many years past, they have directed special efforts towards interesting architects in the gas-grate in its bearing both upon economical heating and upon room ventilation. Their view has been—and continued experience only strengthens it—that eventually architects generally will come to specify gas-grates for new houses with the design and erection of which they are occupied.

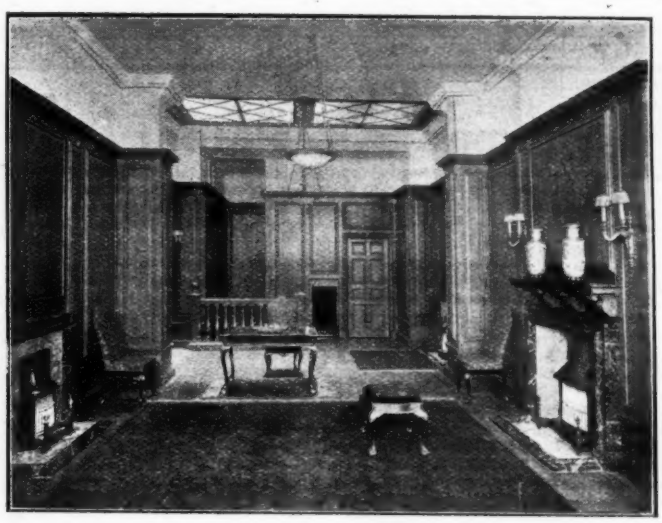
Only a very few years ago this prospect seemed still a far distant one; but to-day many architects up and down the country consistently advocate and specify gas-grates. In order that the general adoption of this practice among the profession may be hastened, Messrs. Wright consider that one important method is to show gas-grates under practical conditions and amid favourable surroundings. They have had this consideration prominent among others in their minds when remodelling—as they have just done—their well-known premises at Nos. 19-21, Queen Victoria Street, London, E.C.

A visit brings home to one the striking metamorphosis which the premises have undergone. The spacious ground-floor area forms a reception-room, panelled well up the walls with rich Austrian oak, and the decoration throughout is in the style of the William-and-Mary period. In this room a small number—some half-dozen only—of the firm's latest "Thermo-Radiant" gas-grates are shown in settings appropriate to themselves and to the style of the apartment. Mantels, back-panels, and hearths, worked with exquisite taste in handsome marbles from the Pyrenees, show how the modern gas-grate may be used to lend adornment to even so sumptuous and refined a scheme of interior decoration, with its magnificent cornice—an exact reproduction of the famous Grinling Gibbons cornice in Hampton Court Palace. It is safe to predict that no visitor, whether a member of the architectural profession or a private householder, will leave this reception-room without being convinced of the great future before these modern gas-grates.

Equally an article of the John Wright creed is the belief that fresh progress ought to be, and can be, made by cultivating the interest of architects in gas-heated hot-water supply for domestic purposes; and on descending the handsome oak staircase to the lower floor, there may be seen a representative series of the firm's apparatus of this class, as well as their gas-steam radiators, gas-cookers, and a variety of additional types of their gas-grates.

Altogether there is something unique about these transformed London headquarters of Messrs. Wright. It is not a shop; it is not a showroom; it is as different as possible from either. It is a place pervaded with an atmosphere of quiet dignity and high decorative tone—restful and charming to the artistic eye, and at the same time convincing to the practical mind; and it may well be believed that it initiates a new idea in the adaptation of such premises to the fostering of the public education in the supreme virtues of gas and gas consuming apparatus.





Two Views of Messrs. John Wright's Premises in Queen Victoria Street, E.C.

**Gas Claims in Ireland.**—In connection with the recent malicious destruction of property in Ireland by armed and other bands acting in opposition to the Free State Government, the Alliance and Dublin Consumers' Gas Company have lodged a claim for £9456; and the Tipperary Gas Company, one for £1020.

**The Suggested Therm Inquiry.**—At last Tuesday's meeting of the London County Council, Mr. Ernest Sanger (the Chairman of the Public Control Committee) stated, in reply to a further question on the subject, that no answer had yet been received from the Board of Trade. Should it not come within the next few days another letter would be sent pressing for a reply to the Council's request for an immediate inquiry.

**Gasholder Building in New Zealand.**—The Wellington firm of Messrs. Dougall Coombs have started what is said to be practically a new industry for New Zealand, their tender having been accepted by the Blenheim Corporation for the erection of a new holder at the municipal gas-works. The holder is to be spiral guided, two-lift, and about 70 ft. in diameter. The concrete tank has already been constructed by the Gas Department. This is of reinforced concrete; and all the gravel required for the work was obtained from the ground excavated. Mr. A. H. Atkinson is the Engineer.

**New Gas Capital.**—Messrs. Hussey and Sons recently sold by auction at the Company's offices 2000 £10 new ordinary shares in the Exeter Gas Company, ranking for a standard dividend of 7 p.ct. per annum, subject to the sliding-scale. All the shares were sold at prices ranging from £13 2s. 6d. to £11 10s. each. Messrs. A. & W. Richards are offering for sale by tender 9000 £5 6 p.ct. redeemable preference shares in the Romford Gas and Coke Company, Ltd. The minimum price of issue is par; and they are to be redeemed at par.

**A Pleasant Change.**—When things go wrong at the gas-works, or service is deficient, or for any other reason, the public are quick to complain; but seldom is anything heard in the way of publicly-expressed satisfaction. It is a welcome change, therefore, to notice at Morecambe candid congratulations, through the local Press, on good service by the Gas Department. "We do not know who is responsible for the changes," it is said, "but whether it be the Chairman, the Manager, or any of the Committee, the fact remains that consumers, according to outside reports, are receiving more attention than ever they have since the gas-works were started—and that is saying a great deal. . . . It is pleasing to see that the Committee, with the Manager (Mr. Barratt), are determined to push the business and make consumers perfectly satisfied."

## GAS REGULATION ACT ORDERS.

There have been received from the Director of Gas Administration copies of the following further Orders made by the Board of Trade under section 1 of the Gas Regulation Act.

### Alfreton Gas Company.

After the declared date, the standard price in respect of gas supplied by the undertakers shall be 17d. per therm.

For the purpose of ascertaining the authorized rate of dividend, any price charged per 1000 c.ft. before the declared date shall be rendered into the equivalent price per therm by dividing it by five. (Nov. 17.)

### Sandbach Gas Company.

After the declared date, the standard price in respect of gas supplied by the undertakers shall be 14·8d. per therm.

For the purpose of ascertaining the authorized rate of dividend, any price charged per 1000 c.ft. before the declared date shall be rendered into the equivalent price per therm by dividing it by four-and-three-quarters. (Nov. 17.)

## DUBLIN CORPORATION DEMAND AN INQUIRY.

### Gas Quality and Price.

With two dissentients, the Dublin Corporation passed a resolution calling on the Free State Provisional Government to hold an inquiry into the quality of gas supplied by the Alliance and Dublin Consumers' Gas Company, and also into the question of pressure, price, and method of charge. A resolution asking for such an inquiry had been passed in common and forwarded by the Dublin township Councils of Pembroke, Rathmines and Rathgar, and Blackrock, and had been referred to the Electricity and Public Lighting Committee.

Mr. JOHN FARREN, the proposer of the Corporation resolution, remarked that in Belfast and other centres gas was produced more cheaply than in Dublin—in Belfast at nearly half the price of Dublin, 3s. 8d. per 1000 c.ft. against 6s. 9d. In Dublin they were promised a reduction of 1d. per therm in the coming year, which would mean a concession of 1d. per 220 c.ft. The report of the Company for the half year to June showed a profit of £50,678; and if the revenue which he considered was wrongly applied to expenditure were included, the profit would certainly have amounted to £100,000. The Company had built new coal boats out of the revenue, and, in fact, had made a new gas-works at the expense of the people of Dublin; and it was time the Government stepped in. The Corporation should be represented at the inquiry, if it was granted.

Alderman SHIELDS, in seconding, said the Company's revenue for the twelve months ended June last was about £533,000, and the Corporation should take measures to see that the consumers were properly treated.

Alderman HUBBARD CLARK thought the Provisional Government had enough work on hand at present, and argued that it was an impertinence for the Corporation to ask for an inquiry into the price of gas, while they were themselves charging exorbitant rates for electricity. The therm system was not the Company's arrangement, but was imposed by Act of Parliament after due inquiry by the Board of Trade. The Act protected the consumer as regards price and quality. In the present quarter there was an increase in consumption of gas, which was no argument that prices were excessive. In November, 1921, the therm system was adopted in Dublin, and in twelve months there was a reduction of 3d. per therm, equivalent to 1s. 1½d. per 1000 c.ft. Up to the last half year the Company's dividend was not more than 5 p.ct.

Mr. M. J. MORAN urged that the price charged and the profits made by the Gas Company were good reasons for an inquiry.

Sir ANDREW BEATTIE gave it as his opinion that if electric light were cheaper there would be more competition. He moved as an amendment that a Commission be appointed to inquire as to how far the price of electricity could be reduced.

The LORD MAYOR (Mr. L. O'Neill) declared the proposed amendment out of order.

Mr. RAUL (the Chairman of the Electricity Committee) supported the motion, which was passed; Alderman Clark and Sir Andrew Beattie intimating dissent.

**A Middlesbrough Gas Explosion.**—While workmen were engaged in renewing a gas-main outside a house in Middlesbrough, on Thursday last, an explosion occurred which, injured four of the men and severely damaged the house and contents. The injuries of one of the men, John Garbutt, were serious.

**Co-Partnership and Labour Unrest.**—Lord Emmott, dealing with the relations of capital and labour, in his Presidential Address to the Royal Statistical Society, said that profit-sharing and co-partnership appeared to him to be the only practicable methods of meeting all the legitimate grievances of labour. He referred to the large number of experiments already made, and pointed out that the number of failures, where the schemes were sound, were far smaller than was ordinarily supposed. He did not think, however, that profit-sharing on a cash basis could be a permanent solution of industrial trouble. It was important that the worker should have an interest in the trade in which he worked—that, in fact, he should, by saving and investment, become a capitalist on a small scale, and thus gain personal experience of the meaning of productive capital. By these means the worker would eventually acquire the necessary knowledge and experience to fit him to take an active part in the control of industry. Though the adoption of profit-sharing and co-partnership was neither easy nor simple, he believed it to be a real, and possibly a permanent, remedy for industrial unrest.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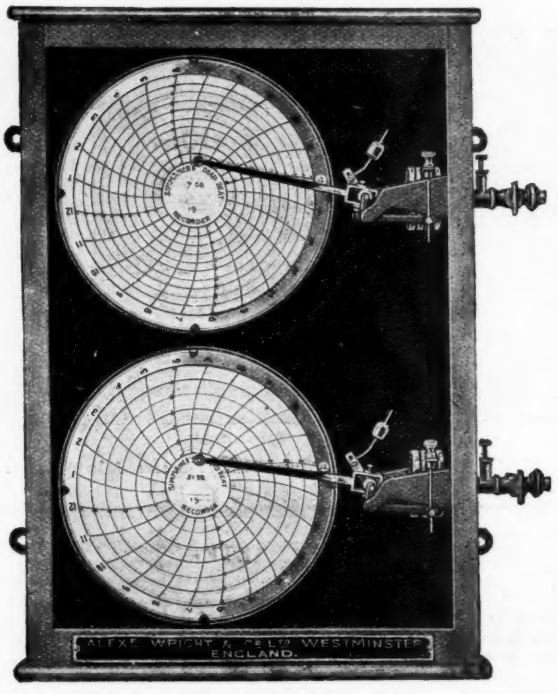


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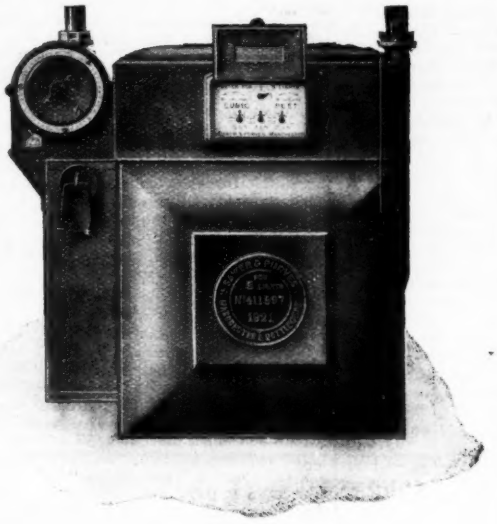

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## TRADE NOTES.

**An Example of Reliability and Durability.**

Messrs. George Glover & Co. have received a letter (dated November of this year) from which the following is extracted: "It may interest you to know that we have this week taken out a dry tin-cased gas-meter, made by George Glover, dated 1867—that is 55 years ago. This meter has been in use and working until now."

**"Simplex" Water-Gas Plant.**

A number of installations have been put down by the Vertical Gas Retort Syndicate, Ltd., No. 17, Victoria Street, S.W., of the "Simplex" blue and carburetted water-gas plant—a complete self-contained plant, which can be worked in conjunction with the coal-gas retorts, in the same building, by the same men, coupled direct to the foul main, and not requiring auxiliary plant or a relief holder. Photographs of a few of the installations appear in a pamphlet newly issued by the Syndicate, who point out that the plant is primarily intended for those works which are already taxed to their full capacity, and have no space to extend, or money for large capital outlay. It is able to meet sudden demands, thus rendering unnecessary the keeping of a spare bed of retorts under fire. A diagram is given to indicate the simplicity of the apparatus in operation; and there are also some comparative working results, showing an increase of 2935 c.ft. in the make of gas per ton of coal carbonized with the plant in use, and a decrease of less than ½ cwt. in the coke for sale per ton of coal. The well-known "Sydenham" grate is employed in the "Simplex" plant.

## CURRENT SALES OF GAS PRODUCTS.

### The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Nov.* 27.

There is little new to report in the London tar products market. Pitch is without change, and the price is firm at not below 125s. per ton f.o.b. makers' works. Creosote is an advancing market; the price being in the neighbourhood of 8d. per gallon net and naked. Pure benzole and pure toluole are about 2s. 6d. per gallon. Solvent naphtha 95/160 is from 2s. to 2s. 1d. per gallon.

### Tar Products in the Provinces.

*Nov.* 27.

The average values for gas-works products during last week were: Gas-works coal tar, 69s. to 74s. Pitch, East Coast, 117s. 6d. to 122s. 6d. f.o.b. West Coast—Manchester, 117s. 6d. to 120s.; Liverpool, 118s. 6d. to 121s.; Clyde, 120s. to 122s. 6d. Benzole 90 p.ct. North, 1s. 9d. to 1s. 10d.; crude 65 p.ct. at 120° C., 1s. 1½d. to 1s. 2½d. naked at makers' works; 50-90 p.ct., naked, North, 1s. 10d. to 1s. 11d. Toluole, naked, North, 2s. to 2s. 3d. nominal. Coal tar crude naphtha in bulk, North, 8½d. to 9½d. Solvent naphtha, naked, North, 1s. 8d. to 1s. 10d. Heavy naphtha, North, 2s. to 2s. 1d. Creosote, in bulk, North, liquid, 6½d. to 6¾d.; salty, 5¾d. to 6d. Scotland, 5d. to 5½d. Heavy oils, in bulk, North, 6½d. to 6¾d. Carbolic acid, 60 p.ct., 2s. to 2s. 1d. Naphthalene, £12 to £15; salts, £5 to £5 10s., bags included. Anthracene, "A" quality, 5d. per minimum 40 p.ct., purely nominal; "B" unsaleable.

### Manchester District Tar Prices.

The average price realized for the sale of tar in the Manchester district, according to the sliding-scale, for the month of October was £3 14s. 7·64d. per ton.

## FROM A MARKET CORRESPONDENT.

### The Bye-Products Trade.

There is practically no fresh news to report in the market for tar products this week. Information is to hand of the reopening of several more blast-furnaces and coke-ovens—a movement which is certain to continue as the outcome of the better conditions of trade. Although this will be productive of increased supplies of tar products, there is no sign of weakness where prices are concerned. The Continental traffic in pitch is still good, and prices are maintained in the neighbourhood of £5 per ton. Solvent naphtha is steady on a continued demand from the rubber manufacturing industry. Heavy naphtha is also without change. Benzole exhibits a falling away tendency in the wake of petrol. Naphthalenes are dull at £17 per ton for refined and £4 10s. for crudes. Creosote keeps at 6½d. per gallon. Cresylic acid remains 2s. 4d. to 2s. 8d. per gallon. Carbolic acid crude 60's is at 2s. 1d. per gallon, with crystals 40 p.ct. 7d. per lb. In intermediate products there is nothing to report, although there is still much inquiry on Continental account.

### Sulphate of Ammonia.

There is no change here. Material is still on the scarce side, with many inquiries for export. Nitrogen values are advancing throughout the world; and it is fairly obvious that prices for sulphate for next year's consumption must be advanced again.

**Price of Newton Abbot Gas.**—In consequence of complaints of the high price of gas at Newton Abbot, Mr. J. G. Clarke (Manager of the Newton Gas Company) attended the meeting of the Urban Council, and explained that there had been two reductions in the price, which was now 5s. 5d. per 1000 c.ft., compared with 3s. 9d. in 1914. This was an increase of less than 50 p.ct., while the working expenses of the Company had increased by 126 p.ct. The undertaking was very economically managed, and if it were owned by the town the price of gas could not be cheaper. The gas manufactured in Newton Abbot to-day was considerably better than in 1914.

# STOCK MARKET REPORT.

THE Stock Exchange has had a most disappointing week. It opened fairly, and with some promise of activity; but a quick change supervened. On Tuesday, markets pretty well all round fell very dull, and continued devoid of life next day. This culminated on Thursday in almost absolute atrophy; and Friday was not much better. The gilt-edged market was a sufferer, and in Home Governments the big four marked: Consols 56⅝-57, War Loan 99½-99 7/16, Funding 87-87⅜, Victory 89-89⅜. Rails were flat, except Argentines. The Foreign Market was shaky, and fluctuated almost daily.

Business in the Gas Market was fairly active, considering the times, and showed marked firmness; all changes in quotation, albeit slight, being in the upward direction. The London Companies were very steady; the only change being a rise of 1 in South Metropolitan preferences—an issue little dealt in. In the Suburban and Provincial group, Bournemouth "B" rose ½, Croydon sliding-scale 1, Newcastle ½, ditto debenture 1. Among the rest, European rose ½, Imperial Continental debenture 1, Malta and Mediterranean ½, and Primitiva preference 3/16.

The following transactions in gas during the week were recorded: On Monday, Cape Town 4½ p.ct. debenture 74½, 75½, Commercial 4 p.ct. 95½, European 9½, 9⅝, 9⅝, 9⅝, Gas Light ordinary 94½, 94⅝, 95, ditto 3½ p.ct. maximum 63, ditto 4 p.ct. preference 79, ditto 3 p.ct. debenture 63, Oriental 100, 101, Primitiva 13s., 13s. 6d., 13s. 10½d., ditto 5 p.ct. preference 45s., 45s. 3d., 45s. 7½d., 45s. 9d., 46s., 46s. 3d., River Plate 4 p.ct. debenture 55, South Metropolitan 95⅜, 96, 96½, ditto 3 p.ct. debenture 61½, ditto 6½ p.ct. debenture 105½, Tottenham "B" 100½, 101¼, 101⅜, Brighton and Hove 7 p.ct. debenture 102, 103, Liverpool 7 p.ct. preference 106½, Southend 5 p.ct. new "B" 70. On Tuesday, Alliance and Dublin 65, 65½, European 9⅜, 9⅜, 9⅞, Gas Light ordinary 94¼, 94½, 94⅜, 95, ditto 3½ p.ct. maximum 62½, 62⅝, ditto 3 p.ct. debenture 62¼, Imperial Continental 151, 151½, 152, Oriental 102, Primitiva 13s. 6d., 13s. 10½d., ditto 5 p.ct. preference 45s., 46s. 3d., 46s. 6d., 46s. 10½d., South Metropolitan 95⅜, 95⅞, 96½, ditto 5 p.ct. preference 95, South Suburban 98½, 99, Folkestone 77, 77½. On Wednesday, Alliance and Dublin 62½, 63, Bombay 95s., Brentford "A" 101, 101½, ditto "B" 100, British 32, ditto 4 p.ct. debenture 76, Continental Union 29, European 9⅜, 9⅜, Gas Light ordinary 94, 94¼, 94⅜, 94⅜, 95, ditto 3½ p.ct. maximum 62⅜, ditto 3 p.ct. debenture 62⅛, Imperial Continental 151½, 152, Lea Bridge 100, Primitiva 12s. 6d., 14s. 3d., ditto 5 p.ct. preference 45s. 9d., 46s. 3d., South Metropolitan 95, 95⅛, 95⅜, 95½, 96, Southampton 80½, Tottenham "A" 115, ditto "B" 100⅜, 101, Liverpool 7 p.ct. preference 106, 106½. On Thursday, Brentford "B" 100¾, 101½, British 32½, 33, 34, Commercial 4 p.ct. 94½, European 9⅜, 9⅝, Gas Light ordinary 94¼, 94½, 94⅜, 95, ditto 4 p.ct. preference 78½, 79, Imperial Continental 151½, Primitiva 14s. 9d., ditto 5 p.ct. preference 45s., 47s. 3d., South Metropolitan 95½, 96, 96⅜, ditto 6½ p.ct. debenture 106½, British (Norwich) 3½ p.ct. debenture 63, 64, Hampton Court 5 p.ct. 97, 97½, Liverpool 7 p.ct. preference 106, 106½. On Friday, Bombay 100s., European 9⅜, Gas Light ordinary 94, 94¼, 94½, 94⅜, 94⅞, 95, ditto 3½ p.ct. maximum 62⅜, ditto 3 p.ct. debenture 62, 62½, Imperial Continental 151½, 152½, Primitiva 14s. 9d., San Paulo 6 p.ct. preference 5⅞, Sheffield "C" 97½, 98, South Metropolitan 95¾, 96, ditto 6½ p.ct. debenture 105, Liverpool 7 p.ct. preference 106, 106½, Swansea 6½ p.ct. debenture 105.

In the Money Market, the initial position was comfortably easy, and thus it stood steady for a couple of days or so. Then a demand sprang up which became more pronounced by Thursday, and the close on Friday was firm. Discount business was quiet and rates were fairly easy at first, and so remained until towards the close, when they hardened materially. The silver market continued to weaken under pressure of sales, and the price fell to 32 7/16d. The Bank of England rate was 3 p.ct., as fixed on July 13.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S TRANSACTIONS.

| Issue. | Share. | When ex-Dividend. | Ante-War Dividend & Bonus. | Last Dividend. | NAME. | Closing Prices, July 30, 1914. | Present Prices. | Lowest and Highest Prices of Transactions. |
|---|---|---|---|---|---|---|---|---|
| £ | | | p.c. | | | | | |
| 182,049 | Stk. | Aug. 24 | 4 | 4% | Aldershot 4 p.c. Pref. | .. | 68—73 | ... |
| 1,551,868 | ,, | Oct. 5 | 2½ | 5% | Alliance & Dublin Ord. | 59—64 | 62—67 | 62½—65½ |
| 374,000 | ,, | July 13 | 4 | 4% | Do. 4 p.c. Deb. | 76—79 | 60—65 | ... |
| 280,000 | 5 | Oct. 19 | 7½ | 4/- | Bombay, Ltd. | 5½—6½ | 4½—5 | 95/—100/- |
| 100,000 | 5 | Aug. 10 | 16 | 7½% | Bournemouth Gas and Water: 5 p.c. | .. | 11—12 | ... |
| 383,110 | 10 | ,, | 7 | 7% | Bournemouth Gas and Water: B 7 p.c. | 15—15½ | 11—12 | ... |
| 115,000 | 10 | ,, | 6 | 6% | Bournemouth Gas and Water: Pref. 6 p.c. | 13½—14 | 8½—9½ | ... |
| 162,065 | — | June 29 | — | 4% | Bournemouth Gas and Water: 4 p.c. Deb. | .. | 73—78 | ... |
| 992,045 | Stk. | July 27 | 14 | 6½/- | Brentford A Consolid. | 261—266 | 100—103 | 101—101½ |
| 734,920 | ,, | ,, | 11 | 6½/3 | Do. B New | 204—209 | 100—103 | 100—101½ |
| 55,000 | ,, | ,, | 5 | 5% | Do. 5 p.c. Pref. | 109—111 | 82—87 | ... |
| 221,400 | ,, | June 15 | 4 | 4% | Do. 4 p.c. Deb. | 91—93 | 75—80 | ... |
| 214,775 | ,, | Aug. 24 | 11 | 11½% | Brighton & Hove Orig. | 208—213 | 165—170 | ... |
| 244,200 | ,, | ,, | 8 | 8½% | Do. A Ord. Stk. | 154—159 | 120—125 | ... |
| 1,287,500 | Stk. | July 28 | 5 | 5% | Bristol 5 p.c. max. | .. | .. | ... |
| 530,000 | 20 | Oct. 5 | 12½ | 22/6 | British | 44—45 | 32—34 | 32—34 |
| 120,000 | Stk. | June 29 | 4 | 4% | Do. 4 p.c. Deb. Stk. | 85—90 | 75—80 | 76 |
| 245,771 | ,, | ,, | 4 | 4% | Buenos Aires 4 p.c. Deb. | 85—87 | 55—60 | ... |
| 100,000 | 10 | Nov. 2 | — | — | Cape Town & Dis., Ltd. | 1½—2½ | 6½—7½ | ... |
| 100,000 | 10 | Oct. 19 | — | — | Do. 4½ p.c. Pref. | 4—6 | 6—7 | ... |
| 100,000 | Stk. | June 29 | 4½ | — | Do. 4½ p.c. Deb. Stk. | 70—75 | 73—78 | 74½—75½ |
| 157,150 | ,, | Feb. 26 | 5 | 5% | Chester 5 p.c. Ord. | 108—110 | .. | ... |
| 1,513,280 | ,, | July 27 | 5/9/4 | 56/- | Commercial 4 p.c. Stk. | 106—108 | 93—98 | 94½—95½ |
| 560,000 | ,, | ,, | 5½ | 55/- | Do. 3½ p.c. do. | 103—105 | 93—98 | ... |
| 475,000 | ,, | June 15 | 3 | 3% | Do. 3 p.c. Deb. Stk. | 69½—71½ | 55—60 | ... |
| 800,000 | ,, | Dec. 15 | 4 | — | Continental Union, Ltd. | 76—79 | 29—34 | 29 |
| 200,000 | ,, | ,, | 7 | 3% | Do. 7 p.c. Pref. | 115—118 | 51—56 | ... |
| 660,000 | | Sept. 1 | .. | 6% | Croydon sliding scale. | .. | 96—101 | ... |
| 284,975 | | ,, | — | 5% | Do. max. div. | .. | 80—85 | ... |
| 492,270 | Stk. | — | 6 | 4½% | Derby Con. Stk. | 123—125 | .. | ... |
| 55,000 | ,, | — | 4 | 4% | Do. Deb. Stk. | 102—104 | .. | ... |
| 1,002,180 | 10 | July 13 | 10 | 5/0 | European, Ltd. | 17½—18 | 9½—10½ | 9½—9½ |
| 16,298,975 | Stk. | July 27 | 4/17/4 | 52/- | Gas: 4 p.c. Ord. | 98—102 | 94—96 | 94—95 |
| 2,600,000 | ,, | ,, | 3½ | 35/- | Gas: 3½ p.c. max. | 76—79 | 61—64 | 62½—63 |
| 4,062,235 | ,, | ,, | 4 | 4% | Light and Coke: 4 p.c. Con. Pref. | 96—99 | 76—81 | 78½—79 |
| 4,674,850 | ,, | June 15 | 3 | 3% | Light and Coke: 3 p.c. Con. Deb. | 72½—74½ | 61—64 | 62—63 |
| 130,000 | ,, | Dec. 11 | 10 | 10% | Light and Coke: 10 p.c. Bonds | .. | .. | .. |
| — | — | — | — | — | Light and Coke: 7½ p.c. Ilford Deb | .. | .. | ... |
| 82,500 | ,, | Sept. 21 | 5 | 65/7½ | Hastings & St. L. 5 p.c. | .. | 95—100 | ... |
| 258,740 | ,, | ,, | 3½ | 50/7½ | Do. 3½ p.c. | 87—89 | 77—80 | ... |
| 70,000 | 10 | May 18 | 11 | 7½% | Hongkong & China, Ltd. | 16½—16½ | 6—7 | ... |
| 86,600 | Stk. | Aug. 24 | 9 | 9½% | Hornsey 7 p.c. | .. | 127—132 | ... |
| 1,976,000 | ,, | Nov. 16 | 9 | £5 | Imperial Continental | 150—160 | 150—155* | 151—152½ |
| 404,800 | ,, | Aug. 10 | 3½ | 3½% | Do. 3½ p.c. Deb. Red. | 84—86 | 73—76 | ... |
| 235,242 | ,, | July 27 | 6½ | 6½% | Lea Bridge Ord. 5 p.c. | 119—121 | 95—100 | 100 |
| 2,498,905 | ,, | Feb. 26 | 10 | 37/6 | Liverpool 5 p.c. Ord. | .. | .. | ... |
| 165,736 | ,, | Aug. 10 | 7/5/6 | 87/3 | Maidstone 5 p.c. | .. | 87—92 | ... |
| 63,480 | ,, | June 29 | — | 3% | Do. 3 p.c. Deb | .. | 54—59 | ... |
| 75,000 | 5 | ,, | 6 | 6% | Malta & Mediterranean Met. of Melbourne: 4½ p.c. Deb. | 4½—4½ | 3½—4 | ... |
| 250,000 | 100 | Oct. 2 | 4½ | 4½% | Monte Video, Ltd. | 99—101 | 89—96 | ... |
| 541,920 | Stk. | June 1 | 4 | 4% | Newcastle & Gatsh'dCon. | 11½—12 | 60—65 | ... |
| 1,875,892 | ,, | July 27 | 4½ | 4½% | Do. 3½ p.c. Deb. | 98½—99½ | 79—80 | ... |
| 529,705 | ,, | June 29 | 3½ | 3½% | North Middlesex 10 p.c. | 82—83 | 69—71 | ... |
| 15,000 | 10 | Aug. 26 | — | 7/6 | ,, ,, 7 p.c. | .. | .. | ... |
| 55,940 | 10 | Aug. 24 | 7/14/0 | 7/8⅝ | Oriental, Ltd. | 14—15 | 10½—11½ | ... |
| 300,000 | Stk. | May 18 | 8 | 8% | Ottoman, Ltd. | 117—122 | 98—103 | 100—102 |
| 60,000 | 5 | — | 10 | — | Plym'th & Stonh'se 5 p.c. | 7½—7½ | 2—3 | ... |
| 188,120 | Stk. | June 29 | — | 6/3/9% | Portsea Island, B | .. | 93—98 | ... |
| 60,000 | 50 | Aug. 24 | 13 | 65/- | Do. C | 128—131 | 100—105 | ... |
| 100,000 | 50 | ,, | 12 | 60/- | Primitiva Ord. | 118—121 | 85—90 | ... |
| 249,980 | 5 | — | 8 | — | Do. 5 p.c. Pref. | 5½—6 | 1/16—1/8 | 13/—14/9 |
| 499,960 | 5 | — | 5 | — | Do. 4 p.c. Deb. | 4½—5 | 2 1/16—2 1/16 | 45/—47/3 |
| 521,600 | 100 | June 1 | 4 | 4% | Do. ,, ,, 1911 | 91—93 | 70—75 | ... |
| 600,000 | Stk. | July 27 | 4 | 4% | River Plate 4 p.c. Deb. | .. | 55—60 | ... |
| 346,198 | ,, | June 29 | 4 | 4% | San Paulo: 6 p.c. Pref. | 85—87 | 55—60 | 55 |
| 150,000 | 10 | Sept. 21 | 6 | 6/- | San Paulo: 5 p.c. Deb. | 10½—11 | 5½—6 | 5⅝ |
| 125,000 | 50 | July 3 | 5 | 5% | Sheffield A | 47—49 | 35—38 | ... |
| 135,000 | Stk. | Aug. 24 | 10 | 5% | Do. B | 223—224 | 97—99 | ... |
| 209,984 | ,, | ,, | 10 | 5% | Do. C | 222—224 | 97—99 | ... |
| 523,500 | ,, | ,, | 10 | 5% | Shrewsbury 5 p.c. | 220—222 | 97—99 | 97½—98 |
| 133,201 | Stk. | Sept. 15 | 4 | 4% | South African | .. | .. | ... |
| 90,000 | 10 | Nov. 2 | 9 | 7% | South Met. Ord. | 10½—11½ | 7—9 | ... |
| 6,609,895 | Stk. | July 27 | 5/4/0 | 5% | Do. Red. Pref. | 111—113 | 95—97 | 95—96½ |
| 250,000 | ,, | July 13 | — | 5% | Do. 3 p.c. Deb. | .. | 95—97 | 95 |
| 1,895,445 | ,, | ,, | 3 | 3% | South Shields Con. Stk. | 72½—74½ | 61—64 | ... |
| 224,820 | ,, | Aug. 24 | 8½ | 8½% | S'th Suburb'n Ord. 5 p.c. | 157—159 | 106—108 | ... |
| 1,087,795 | ,, | ,, | 6 | 6% | Do. 5 p.c. Deb. Stk. | 114—116 | 97—100 | 98½—99 |
| 368,837 | ,, | June 15 | 5 | 5% | Southampton Ord. | 116—118 | 95—100 | ... |
| 647,740 | ,, | Nov. 2 | 5 | 7% | Do. 4 p.c. Deb. Stk. | 99—102 | 77—82* | 80½ |
| 121,275 | ,, | June 29 | 4 | 4% | Tottenham: A 5 p.c. | .. | 63—68 | ... |
| 120,000 | ,, | July 27 | — | 7½% | Tottenham: B 3½ p.c. | 135—138 | 112—117 | 115 |
| 782,275 | ,, | ,, | 6 | 6% | Tottenham: 4 p.c. Deb. | 115—117 | 100—103 | 100½—101¾ |
| 181,255 | ,, | June 15 | 4 | 4% | Tuscan, Ltd. | 87—89 | 75—80 | ... |
| 182,380 | 10 | Dec. 30 | 5 | — | Do. 5 p.c. Deb. Red. | 5—6 | ⅛—⅜ | ... |
| 149,900 | 10 | July 1 | 5 | 5% | Tynemouth 5 p.c. max. | 93—95 | 20—30 | ... |
| 236,476 | Stk. | Aug. 24 | 5 | 2½% | Wandsworth, Wimbledon, and Epsom— | 108½—109 | 79—81 | ... |
| 30,000 | ,, | July 27 | 8½ | 72/6 | Wandsworth A 5 p.c. | 151—156 | 111—115 | ... |
| 235,636 | ,, | ,, | 6½ | 57/6 | Do. B 3½ p.c. | 129—134 | 95—100 | ... |
| 108,075 | ,, | ,, | — | 50/9 | Do. C. | .. | 87—92 | ... |
| 140,865 | ,, | ,, | — | 50/9 | New Ordinary | .. | 87—92 | ... |
| 352,000 | ,, | ,, | 6½ | 53/9 | Wimbledon 5 p.c. | 117—122 | 95—100 | ... |
| 98,000 | ,, | ,, | 6½ | 58/9 | Epsom 5 p.c. | 121—126 | 95—100 | ... |
| 88,416 | ,, | June 29 | 3 | 3% | 3 p.c Deb. Stk. | 66—69 | 57—60 | ... |

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## A New Gasholder at Annan.

In order to cope with the increasing demand for gas in the district, the Annan Gas Company have provided a new holder, the inauguration ceremony in connection with which was performed last week by Mrs. Murray Little, whose grandfather was one of the pioneers of the gas-works 85 years ago. Ex-Provost Foster presided. The holder, a two-lift spiral-guided one, was constructed by Messrs. R. & J. Dempster, Ltd., of Manchester, under the direction and supervision of Mr. Herbert Lees, of Hexham. It has a working capacity of 120,000 c.ft. of gas; and the total height when fully inflated will be upwards of 65 ft. The tank is 63 ft. 6 in. in diameter by 22 ft. deep. The ceremony was preceded by luncheon in the Central Hotel, at which Mr. Lees proposed "The Contractors," and said the whole of the work has been exceedingly well done. There was one feature about Messrs. R. & J. Dempster which was worth noting, and this was that they seldom put in any extras. Not only was that the case here, but he believed there might be some reduction on the original contract price. Mr. J. W. Scott (representing Messrs. Dempster), in response, said he could reciprocate the kind things which Mr. Lees had been pleased to say about the firm. Mr. Lees had an established reputation as an engineer in the North of England. He was a man who knew what he was about; and every firm who carried out a contract in which he was concerned did so to the very best of their ability. The Annan Gas Company, after thirty years' experience of a spiral holder, had sufficient faith to go in for another one of the same type. After Mrs. Murray Little had turned on the gas from the new holder to the town, she was presented by Mr. Scott with a handsome silver salver.

The Oban District Gas Company, Ltd., have reduced the price of gas by 5d. to 7s. 11d. per 1000 c.ft.

A further reduction in the price of their British made mantles has been announced by Messrs. D. Hulett & Co., Ltd., of Nos. 57 and 58, Chancery Lane, London, W.C. 2.

Owing to good management on the part of the Directors in entering into favourable coal contracts, the Sandbach Gas Company will be able to reduce the amount per therm in their application to the Board of Trade for an Order under section 1 of the Gas Regulation Act.

A staff fancy-dress dance arranged by the National Benzole Company, Ltd., and the Agwi Petroleum Corporation, which took place at the Wharncliffe Rooms, Great Central Hotel, Marylebone, proved to be a very successful evening. Many valuable prizes were given. Mr. A. Read, Vice-Chairman of the National Benzole Company, speaking on behalf of the combined Directorate, welcomed the opportunity of becoming more personally acquainted with members of both staffs.

With reference to the public lighting of the Newchapel area of the Kidsgrove Urban Council, a letter has been addressed to the Council from the Chief Engineer of the Stoke-on-Trent Corporation, stating that he had placed the communication from the Kidsgrove Council before his Committee, who had instructed him to say that they would further consider the question after the terms for street lighting in the county borough had been settled with the Highways Committee. Mr. Townley complained that Newchapel was in utter darkness, and that they were not being fairly treated by the Stoke-on-Trent Corporation. He moved that a meeting of the Council be held at an early date to discuss the subject of lighting; and this was agreed to.

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Telephone: RUSHOLME 976. Telegrams: "GASMETER,"
and 46 & 47, Auckland Street, LONDON, S.E. 11.
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## APPOINTMENTS, &c., WANTED.

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## APPOINTMENTS, &c., VACANT.

**WHEN Filling Vacancies, please** REMEMBER THE CLAIM OF THE EX-SERVICE MAN, who, other Qualifications being equal, has the FIRST CALL ON YOUR CONSIDERATION.

### SOUTHPORT, BIRKDALE, AND WEST LANCASHIRE WATER BOARD.

APPOINTMENT OF WATER-WORKS MANAGER AND ENGINEER.

**THE Board invite Applications for** the Appointment of WATER-WORKS MANAGER and ENGINEER.

Applicants must be duly qualified Civil Engineers, not more than 45 Years of Age, and must have had Experience in the Management of a Water-Works Undertaking supplied by Pumping from Deep Wells.

The Salary will be £750 per Annum inclusive.

Particulars of the Qualifications, Duties, and Conditions of Appointment can be obtained from the undersigned.

Applications must be made on the Official Form, and must reach me before Twelve noon on the 11th day of December, 1922.

Canvassing, either directly or indirectly, will be a disqualification.

J. ERNEST JARRATT,
Clerk to the Board.

Town Hall,
Southport,
Nov. 18, 1922.

### WOLVERHAMPTON GAS COMPANY.

APPOINTMENT OF SECRETARY.

**APPLICATIONS are invited for the** above Appointment. Knowledge of Gas Accountancy and Office Routine essential.

Age 30 to 40. First consideration will be given to Candidates who have actually held the Position of Secretary or Under-Secretary to a Gas Company.

Applications, stating Salary requ[illegible], Qualifications, and Experience, to be forwarded to the Chairman not later than 12th of December next.

By order,
(Signed) A. JONES,
Secretary.

Nov. 15, 1922.

**CHEMICAL ENGINEER. — Large** Firm of Constructional Engineers in Midlands require the Services of an ENGINEER DRAUGHTSMAN who has had considerable Experience in all classes of Chemical, Bye-Product, and Gas-Works Plant.
Apply, stating Age, Experience, and Salary required, in strictest confidence, to No. 7230, "GAS JOURNAL," 11, BOLT COURT, FLEET STREET, E.C. 4.

### TUNBRIDGE WELLS GAS COMPANY.

**WANTED—An Outdoor Superinten-** DENT of Practical Experience to take part Control of the Distribution Department. Good Organizer, and accustomed to the Control of Men, thoroughly Experienced in latest Distribution Methods, and Competent to Advise Consumers in the use of Modern Gas Appliances. Commencing Salary, £250.
Applications, endorsed "Distribution Superintendent," stating Age and Experience, together with *copies* of not more than three Testimonials, to reach the undersigned not later than the 6th of December, 1922.

CHARLES F. CATT,
Secretary.

44, High Street,
Tunbridge Wells.

**WANTED — A Fully Experienced** Man to REPAIR and TEST DRY METERS. Permanent Situation to a Suitable Man who will also undertake Gas Fitting Work when not fully Engaged on Meter Repairing.
Apply, E. J. BROCKWAY, Engineer and Secretary, GAS-WORKS, CLEETHORPES.

## PLANT, &c., FOR SALE & WANTED

**FIRTH BLAKELEY, SONS, & CO.,** Ltd., Church Fenton, Leeds, have the following GAS PLANT AT BARGAIN PRICES:
WATER TUBE CONDENSER, 20,000 c.ft. per day, 14 in. Connections.
ANNULAR CONDENSERS. Set of Four nearly new, 12 in. connections.
SCRUBBER WASHER, 750,000 c.ft. per day, 14 in. Connections.
CAST-IRON TOWER SCRUBBERS, 5 ft. dia. by 40 ft. and 4 ft. 6 in. dia. by 18 ft. high.
WRT.-IRON TOWER SCRUBBER, 4 ft. 6 in. dia. by 36 ft. high.
LIVESEY WASHERS, 750,000 c.ft. per day and 100,000 c.ft. per day.
PURIFIERS. Set of four 25 ft. square, perfect.
PURIFIERS. Set of Two 12 ft. square, and Two 9 ft. square.
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EXHAUSTERS and STEAM ENGINES. Two Sets 5000, and many sizes in Stock for Belt driving.
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1 Gasholder and Steel Tank—20,000 c.ft. capacity.
1 Gasholder and Steel Tank—11,000 c.ft. capacity.
1 Gasholder and Steel Tank—9,000 c.ft. capacity.
1 Steel Tank 31 ft. 6 in. by 15 ft. 3 in. deep.
1 Steel Tank 29 ft. 6 in. by 12 ft. 3 in. deep.
J. BATES & SONS, Gas Engineers, WIGSTON LANE AYLESTONE, LEICESTER.

**FOR SALE—250,000 C.Ft. Capacity** GASHOLDER and STEEL TANK, Equal to New. First-Class Condition. Cheap, to save taking into stock.
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Please make offer to No. 7221, "GAS JOURNAL," 11, BOLT COURT, FLEET STREET, E.C. 4.

## COMPANY NOTICE.

### THE GAS LIGHT AND COKE COMPANY.

**NOTICE is Hereby Given, that the** TRANSFER BOOKS of this Company, so far as they relate to DEBENTURE STOCK and BONDS, WILL BE CLOSED at 12.30 o'clock p.m. on Saturday, the 9th prox., for the Half Year ending on the 31st prox., and will be RE-OPENED on the morning of Monday, the 11th prox.

The Interest for the Half Year will be payable on the 1st of January next to the Stockholders registered on the closing of the Books.

By order,
WILLIAM LYLE GALBRAITH.

Chief Office,
Horseferry Road,
Westminster, S.W. 1.
Nov. 25, 1922.

## CONTRACTS OPEN.

### CORPORATION OF CALCUTTA.

NOTICE TO CONTRACTORS.

SUPPLY AND DELIVERY OF LIGHTING STORES.

**TENDERS are invited, in duplicate,** for the Supply and Delivery of GAS MANTLES, GLASS PANES, and double TIN SHEETS for public Street Lamps and Municipal Institutions. Samples of these articles are required and should be addressed to the Superintendent of Stores to the Corporation, 149, Lower Circular Road, Calcutta, carriage paid.

Tenders must include Delivery Free of all Charges at the Corporation Stores, Calcutta, including Duty and Insurance against Breakages and Marine Risks.

The Corporation do not bind themselves to accept the lowest or any Tender, and will be at liberty to accept the whole or part of a Tender. Tenderers may quote for any or all of the items mentioned in the list. Payment will be made when Delivery is accepted.

Tenders should be submitted in Duplicate and should be enclosed in Sealed Covers superscribed "Tender for Lighting Stores." They should be addressed to the Deputy Chairman, Corporation of Calcutta, Central Municipal Office, No. 5, Corporation Street, Calcutta, and should reach him on or before Monday, the 15th January, 1923, up to 2 p.m., when they will be opened in the presence of such Tenderers as may be present. Tenders must remain open for acceptance for at least six weeks from the date of their opening.

Specification, with Tender Form in duplicate and also *copies* of Tender rules, may be obtained in England from the offices of the "GAS JOURNAL" or the "GAS WORLD."

No Tender will be considered unless accompanied by a remittance to the extent of 2½ p.ct. on the total value of such Tender.

Tenderers must abide by the rules in regard to Tenders in vogue in the Corporation, and are required to submit Tenders in duplicate on the Corporation form above referred to.

B. V. RAMIAH,
Secretary to the Corporation.

Central Municipal Office,
Calcutta,
Nov. 7, 1922.

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